Wage Premia in the British Labour Market

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Contents

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A Synopsis

The doctoral dissertation considers the existence of non-competitive wage premia in Great Britain. The research aims to confront the predictions of certain approaches to wage determination with microeconomic data for Great Britain. In so doing, the analysis is mindful of the importance of economic theory in order to provide a basis for empirical work undertaken, which in turn should ideally be focused upon policy-oriented issues.

In addressing the issue of Wage Premia in the British Labour Market, the Thesis also acknowledges the importance of employing large microeconomic datasets in order to understand an issue which is essentially concerned with microeconomic behaviour. To this end, the Thesis employs data at the level of the individual, the establishment and the firm in the British labour market, carrying out both cross-sectional and longitudinal analyses. Non-competitive wages have significant implications for performance alongside wages themselves. Partly as a result, a concern of the author was to go beyond estimation of wage equations with additional explanatory variables, in order to consider these aspects of performance directly. The empirical work reflects this.

In a sense, the body of research traces the three stages of development of the empirical literature on non-competitive wages. This begins with a study of the wages received by individual workers according to their industry affiliation. Competitive theory predicts that contingent upon levels of human capital and non-pecuniary benefits, individuals working in different industries should earn equal amounts : a law of one-price prevails. The analysis therefore attempts to detect the presence of non-competitive rents. Further, the notion that such differentials are non-competitive suggests a relation between their magnitude and industry profitability. The study represents the first attempt to relate industry differentials to measures of industry ability-to pay for Great Britain.

Second, a cross-sectional study of turnover and wages is concerned with the issue of whether an employer may voluntarily pay wages above a market-clearing level in order to prevent employees from quitting the place of work. The paper provides the first microeconomic evidence of wage as well as union effects upon turnover at British establishments.

Third, the issue of whether the forces of wage determination may differ between levels of the firm is considered, focusing upon the employee-executive distinction. Two chapters, employing a large panel of UK companies consider this issue by examining the determination of company-level wages (Chapter 5) and company financial performance (Chapter 6).

At the time of writing, one of the most contentious issues in the area of wage determination in the British labour market refers to the pay of public sector employees and how this compares to that of the private sector. In Chapter 7, among the first individual-level estimates of the differential associated with employment in the public sector for Great Britain are provided.

Finally, the Thesis draws out the policy implications of efficiency wages. Efficiency Wage theory represents one of the main schools of thought regarding the existence of non-competitive wage premia. The issues which arise strike at the core of labour market and industrial policy-making and include unemployment and minimum wage legislation.

To My Father

Gracias por todo.

Amendments - Additions to Text

Chapter 2, p.9 line 5 :

These alternative models, or versions, of efficiency wage theory, to be discussed more fully in Section 4, differ in terms of the mechanism through which a wage premium may tend to enhance performance. The shirking model identifies levels of effort as the key issue whereas the labour turnover model focuses upon avoidance of labour turnover costs. Further benefits of wage premia considered by efficiency wage theory refer to the recruitment of higher quality individuals and employee notions of fairness which may also be linked to levels of effort supplied.

Chapter 5, p.100, line 16 :

Nevertheless, there remain measurement issues which also apply to the executive pay variable. In particular, the likelihood that there may be changes in the identity of the highest-paid director over the sample period and the absence of data on share options held by the highest-paid director need to be acknowledged. These issues are common to the previous studies of executive pay reviewed by Conyon *et al*, (1995).

Chapter 1

Introduction

In examining the nature of non-competitive wage premia in Great Britain, the Thesis addresses the prime concerns of labour market analysis, namely the pricing and allocation of labour.

In the context of efficiency wage theory, the starting point is a labour market characterised by imperfect information and, in this context, the potential use of the wage rate as a means to enhance performance. Not surprisingly, in contributing to our understanding of wage determination, efficiency wage considerations play a potentially crucial role in the economics of unemployment. The failure of markets to clear implies the existence of rents for those in jobs whilst those unable to underbid are subject to (involuntary) unemployment.

The existence of rents and involuntary unemployment may also be associated with models of wage bargaining. The present Thesis also considers aspects of bargaining as a source of wage premia and, where possible, attempts to discriminate between the efficiency wage and bargaining rationales for non-competitive wage premia.

The present Thesis takes the potential importance of efficiency wage and bargaining models, alongside the lacuna in terms of available empirical evidence as its motivation, with this introductory chapter setting out in greater detail the particular motivation for, and background to, each individual chapter.

Chapter 2 reviews the available empirical evidence relevant to the argument concerning whether firms pay efficiency wages and the presence of wage bargaining. The Chapter concludes that, on balance, the evidence has served to support aspects of the two approaches to wage determination. However, greater research needs to be directed towards understanding the conditions that facilitate such payments and, in so doing, develop cleaner tests of the theories.

The most common piece of evidence cited in support of efficiency wage considerations has been the pronounced and persistent inter-industry wage differentials which cannot be explained by non-pecuniary benefits or unobserved ability. Whilst competitive theory appears to fail to explain such differentials, an implication of efficiency wage theory is that those industries which face a relatively high cost (for reasons of the underlying technology) of shirking or turnover will pay higher wages. It has also been suggested that inter-industry wage differentials may reflect inter-industry variations in bargaining conditions. Chapter 3 provides cross-sectional and panel data estimates of wage differentials by industry affiliation using the British Household Panel Survey. Moreover, the analysis also considers the possible relation between these differentials and certain industry characteristics, including profitability. It is also worth emphasising that a study of inter-industry wage differentials is of interest at the level of characterising a dimension of the wage distribution, in the same manner that studies of other wage differentials in the labour market proceed.

Nevertheless, it is argued that rather than providing convincing evidence of efficiency wage payments, this line of research is better able to indicate the presence of non-competitive rents in wages. The results obtained in Chapter 3 suggest that there may be significant variation in wages by industry affiliation, even after controlling as fully as possible for levels of human capital. Whether these differentials originate in efficiency wage or bargaining considerations is unresolved. A further set of evidence is therefore necessary to provide the link between the motives for payment of efficiency wages and their existence.

It is with this in mind that the Thesis turns to an analysis of turnover and wages in British establishments. Chapter 4 uses cross-sectional data from the Workplace Industrial Relations Survey of 1990 to consider whether employers may pay higher rates of pay to their employees in order to prevent quits. This corresponds to the efficiency wage model of Salop (1979) (see also Campbell, 1993). In this Chapter we begin by demonstrating that the view that a small quantitative impact of wages upon quits or separations need not imply the absence of a motive to offer a wage in excess of the market-clearing level but may instead reflect the coincident presence of bargaining. Empirical results indicate a significant negative effect of wages upon rates of turnover, supporting the central hypothesis. This provides the first micro-economic evidence of such a relationship for Great Britain. Inter alia, the research also considers the scope for union voice (Freeman, 1980) in the analysis of turnover.

Chapter 5 turns to a third source of microeconomic data, in the form of a company accounts panel data models. Company accounts data offers detailed firm level financial data on a range of characteristics relevant to wage determination. Dynamic panel data techniques designed for unbalanced panels afford the opportunity of exploiting this data in order to address the relevant hypotheses. The chapter focuses on the variation in the forces of wage determination according to the level of the firm that is, an employee versus executive distinction. The analysis attempts to consider evidence of long-run profitability effects in determining company-level wages as suggested by bargaining models.

Chapter 6 continues this analysis of the employee - executive distinction in company-level wages. A central tenet of efficiency wage theory is that efficiency wage considerations will take on greater significance and wage levels will be higher, where problems of monitoring are most acute (Krueger, 1991). In this context we may reasonably assume problems of monitoring to be more severe at the executive vis a vis the employee level. The basis to the empirical analysis in Chapter 6 is the argument that efficiency wage theory predicts a positive wage effect in a product market performance equation. Results provide stronger support for efficiency wages at the executive level, as evidence for the implied positive spillover from the (executive) wage in the performance equation is found. However, in the case of both employees and executives, bargaining takes on greater significance with gains in market share.

It may also be highlighted that each of the contexts in which we consider the efficiency wage issue are of significant interest in their own right. This point was made above in the context of the analysis of inter-industry wage differentials. In addition, this point equally applies to the two further studies, of labour turnover and financial performance.

In the analysis of wage determination, it is common practice to restrict the analysis to the private sector. The implication would appear to be that there is something inherently different in the public sector which calls for a separate study of wage determination for this sector of the economy. Moreover, any variation in the way in which wages are determined between the public and private sectors is clearly an issue of some concern from a public policy perspective. However, despite this importance, the wage differential on the basis of public sector affiliation appears to be one of the least-examined. In the light of this, in Chapter 7 we turn to an analysis of public versus private sector wages. The possibility of wage premia according to public sector affiliation is therefore considered with much emphasis being upon variation around any average wage differential.

At the level of methodology, the central points to be emphasised reflect the use of economic theory to obtain predictions which are then to be confronted with data. In turn the implications of the analysis are also drawn out. This latter point is the focus of Chapter 8 which considers the various policy implications of efficiency wage theory.

In terms of the empirical analysis, the use of microeconomic data is to be stressed. In order to confront economic theory based on the behaviour of micro agents (employers and individuals) with data, it seems most appropriate that the form of that data is also at the micro-level (Oswald, 1992). Micro-data also offers the opportunity of avoiding certain uncertainties which may result from aggregation bias. The study employs three different types and sources of micro data and, as a result, employs a variety of techniques to address a range of econometric issues. Such issues in turn are directed at a set of factors of substantial importance to the functioning of labour markets in Great Britain.

Chapter 2

Efficiency Wages and Wage Bargaining : A Literature Review

Abstract

The present chapter surveys the literature on efficiency wage models with a bias towards the available empirical evidence. In so doing, the central concern is to make clear the source of the discriminating hypotheses, that is the way in which the predictions obtained on the basis of an efficiency wage model differ from those which would be consistent with a competitive or bargaining approach. It is concluded that it is in this respect that the weakness of previous studies lies but that nevertheless, significant evidence exists to support aspects of efficiency wage theory. Support is not universal however, and greater research needs to be directed towards understanding what conditions facilitate efficiency wage payments. This would develop efficiency wage models at a theoretical level and, at the same time, allow cleaner tests of the predictions of the approach.

1 Introduction

The economic analysis of labour markets identifies the study of wage differentials and (involuntary) unemployment as its most fundamental concerns. Potentially, efficiency wage models provide a contribution to understanding both. Models of wage bargaining have similarly sharp predictions for the determination of wage differentials and the existence of unemployment. Both approaches contrast with a competitive, market-clearing approach to understanding the functioning of labour markets.

This introductory chapter surveys the literature on efficiency wage and bargaining models with a bias towards the available empirical evidence[1] . The central concern is to make clear the source of the discriminating hypothesis, that is the way in which the predictions obtained on the basis of a differ from those which would be consistent with some alternative approach.

The remainder of the chapter is organised as follows. Section 2 briefly describes the efficiency wage hypothesis. This is followed in Sections 3 and 4 by a survey of the empirical evidence on efficiency wages. A distinction is made between studies which directly consider the determination of wages and those which examine performance where the efficiency wage hypothesis will imply some relation with the latter. Section 5 turns to the empirical literature on wage bargaining, employing U.K microdata. This is followed by some discussion of the scope to combine efficiency wage and bargaining approaches. Section 6 concludes.

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1 Useful surveys of the Efficiency Wage literature, all of which focus upon the theory, can be found in Katz (1986), Stiglitz (1986), Haley (1990) and Layard *et al.*, (1991; Chapter 3).

2 The Efficiency Wage Hypothesis

The central tenet of the efficiency wage literature is the hypothesis that the wage may carry out a secondary role in addition to that of determining the level of employment and that this role is sufficiently important that firms may find it profitable to pay wages at above market-clearing levels.. The level of efficiency at the firm is not an exogenous parameter in the production function but is a function of the firm's wage policy.

More formally, we may take as our starting point, price being a function of total industry output which consists of that of, say, two firms,

$$P = P(X+Y)$$

with,

$$P'(.)<0 \qquad P''(.)=0 \tag{1}$$

Output of Firm 1 is specified as :

$$X = F(eL) \tag{2}$$

The effort function e(.) is given by :

$$e(W-A) = 1 + \gamma\,(W-A)^{\alpha} \tag{3}$$

$$e'(.) > 0 \; ; \qquad e''(.) < 0$$

in which γ varies across firms and reflects the degree to which employment conditions imply effort depends upon the wage offer and hence facilitate efficiency wage payments

The profitability of Firm 1 is then given as :

$$\pi = P(X+Y)X - WL \tag{4}$$

Deriving the first-order conditions :

$$\pi = P(F(eL)+Y)F(eL) - WL \tag{4b}$$

$$\pi_L = P_F\, F'(.)e\,F(eL) - W + P(.)F'(.)e$$

$$= PF'\left\{\frac{P_F}{P} e\,F(.) + e\right\} - W = 0$$

$$\pi_L = e\,P\,F'(.)\left\{1+\frac{1}{\eta}\right\} - W = 0$$

since, $\frac{1}{\eta} = P_F\frac{F}{P}$ and η represents the industry price elasticity of demand.

Dividing through by e gives our first-order condition in employment-setting :

$$\pi_L = P\,F'(.)\left\{1+\frac{1}{\eta}\right\} - \frac{W}{e} = 0 \qquad (5)$$

such that the efficiency wage, *(W/e),* will be set to equal the marginal revenue product of labour.

Partial differentiation of (4b) w.r.t. the wage, w, gives,

$$\pi_W = P_F\,F'(.)e_W\,L\,F(.) + F'(.)e_W\,L\,P - L = 0$$

$$\pi_W = P\,F'(.)\left\{\frac{P_F}{P}L e_w\,F(.) + L e_W\right\} - L = 0$$

again given that $\frac{1}{\eta} = P_F\frac{F}{P}$ and taking out $L\,e_w$ as a common factor for the term in parentheses, we have :

$$\pi_W = P\,F'(.)\left\{1+\frac{1}{\eta}\right\}L e_W - L = 0$$

Now dividing through by $L\,e_w$,

$$\pi_W = P\,F'(.)\left\{1+\frac{1}{\eta}\right\} - \frac{1}{e_W} = 0 \qquad (6)$$

From Equations (5) and (6), it is clear that :

$$\frac{W}{e} = \frac{1}{e_W} \quad\Rightarrow\quad \varepsilon \equiv \left(\frac{\partial e}{\partial W}\right)\left(\frac{W}{e}\right) = 1 \qquad (7)$$

such that the familiar Solow Condition (Solow, 1979) holds. The efficiency wage will be set at a level at which the elasticity of effort with respect to the wage is unity.

The above presentation captures the flavour of efficiency wage theory in the sense that it shows how the level of efficiency at the firm is not an exogenous parameter in a production function but rather depends upon the wage policy of the firm. Alternative models in the mould of efficiency wage theory do, however, offer further suggestions as to what may influence efficiency. In particular the gift exchange model of Akerlof (1982) would suggest that relative wages within the firm are an important further concern as is the profitability of the enterprise in influencing worker effort.

The Bonding Critique

The most significant criticism of efficiency wage theory centres on the argument that in response to a shirking or turnover problem, the firm has alternatives available to it which do not require the payment of an efficiency wage (e.g. Carmichael, 1990). Thus efficiency wage theory artificially restricts attention to one solution to a potential effort or turnover problem. This view is made all the more powerful by stating that the posting of an up-front bond offers a pareto efficient outcome. Hence an excess supply of labour to the firm can be obviated by requiring the payment of a bond which equilibrates demand and supply. This fee will then be foregone if the worker is caught shirking or quits the firm.

The first point to note about the bonding critique is that it does not apply to the gift exchange or adverse selection models. In such models the posting of a bond would not address the second aspect (i.e. beyond determining employment) of paying a wage in efficiency wage models : either to improve morale (asking for workers to pay entrance fees may have an adverse effect here) or recruiting higher quality workers.

In addition, Akerlof and Katz (1989) show that a steep age - earnings profile (observed in practice) is not a perfect substitute for the first-best entrance fee (unobserved in practice). Moreover, they demonstrate that in the absence of the first-best bond, steeper age-wage profiles which are market-clearing, do not solve a shirking problem such that the firm still possesses the incentive to offer an efficiency wage.

On its own terms, the bonding critique implies that firms should require an infinitely large bond to be posted whilst the firm commits an infinitesimally small amount of resources to monitoring. In practice we observe significant resources being committed to monitoring and at the same time a significant amount of worker malfeasance (see Dickens *et al.*, 1989). Bonding is incomplete. Two reasons for why this might be the case are typically suggested. First, capital market constraints may render optimal entree fees infeasible, particularly for entree-level workers, in addition to being precluded legally. Second, the employer possesses an incentive to falsely claim worker malfeasance and procure the fee. Whilst a partial response to this comes in the form of reputation effects which may prevent firms reneging, this might be questioned given turnover and uncertainty of firm survival.

The absence of the first-best bond then implies that a second-best outcome is being observed which will also involve either monitoring and / or efficiency wages. This also provides a basis to the analysis of Akerlof and Katz (1989) who solve for the second best optimal case. Hence, the most appropriate response to the bonding critique is made by Dickens *et al.,* (1989) who show that it is the parameters of the model (in terms of the monitoring technology) which determines to what extent the firm pays efficiency wages and / or devotes resources to monitoring. It then becomes an empirical matter to determine whether efficiency wages will be paid. This therefore places a premium upon sound empirical work in this area and it is to this that we now turn.

3 Empirical Evidence on The Efficiency Wage Hypothesis

In reviewing the relevant empirical evidence, a distinction is made between research aimed at estimation of earnings equations and that which considers some aspect of performance. We take each in turn.

3.1 Inter-Industry Wage Differentials

The most indirect evidence cited in support of the efficiency wage hypothesis comes in the form of an analysis of the inter-industry wage structure. Krueger and Summers (1988) take as their starting point for such an analysis the view that under a competitive theory, a law of one price prevails (in the long run) such that workers of equal quality receive equal rewards. In contrast, admitting the likelihood that forms of monitoring technology or turnover costs are likely to vary by industry, suggests the presence of inter-industry wage differentials according to efficiency wage theory. The first step in the empirical analysis is the estimation of cross-section earnings equations on data from the Current Population Surveys (CPS) of 1974, 1979 and 1984.

$$\ln w_{it} = \alpha f_i + X_{it}'\beta + \Sigma\theta_j D_{ijt} + u_{it} \tag{8}$$

X_{it} represents a vector of demographic characteristics and D_{ijt} is a set of industry dummies. In the cross-section analysis $f_i \equiv 1$ and are thus not identified. To the extent that ability, which one would clearly expect to influence wages and which is only imperfectly measured in the set of human capital variables, is correlated with industry affiliation then the coefficients on industry status, θ_j, are biased upwards, and will be picking up an unmeasured ability effect. This assumption may be relaxed by the use of panel data on individuals such that unobserved ability may be represented by the individual-specific terms, f_i. Assuming this to be a fixed effect, taking differences of Equation 8 produces

$$\Delta \ln w_{it} = \Delta X_{it}'\beta + \Sigma\theta_j \Delta D_{ijt} + \Delta u_{it} \tag{9}$$

such that on differencing the influence of unobserved ability disappears from the estimating equation and any correlation between ability and industry affiliation is purged from the analysis.

The estimated wage equations include the standard human capital and demographic controls with the main summary statistic on the importance of industry affiliation being the employment-weighted standard deviation of the industry dummy coefficients. The cross-section results indicate that this is approximately 15 per cent. Consideration of the stability of these differentials over time then lends weight to the view that these differentials persist and do not reflect transitory shocks. The correlation of the estimated industry wage effects for 1974 and 1984 is 0.97.

Slichter (1950) had also commented on the significant degree of regularity in the inter-industry wage structure. Alongside evidence of marked stability in this inter-industry wage structure, Slichter (1950) also illustrated the high correlation in inter-skill group earnings by industry in addition to the positive correlation between earnings and profitability. Earnings also appeared to be somewhat higher in industries where labour costs were relatively small relative to sales revenue. In a sense therefore, Slichter (1950) anticipated the more recent research into inter-industry wage differentials and had also concluded that the competitive model was unlikely to provide an adequate explanation of these relations. Interestingly, Slichter (1950) placed greater emphasis upon "managerial policy" as a determinant of wages.

Such persistent inter-industry wage differentials could only be accounted for by competitive theory if they reflected either non-pecuniary job attributes and / or unobserved labour quality. In either case the equalisation of net advantage still holds. Workers do not earn rents.

The former of these two suggestions is addressed by the inclusion of additional controls for non-pecuniary benefits. The results of Krueger and Summers (1988) indicate that, if anything, the importance of industry affiliation rises.

The issue of unobserved labour quality is more problematic. Krueger and Summers (1988) attempt to address the problem in the manner noted above, by estimating a wage equation in first-differences on the assumption that unobserved ability is a fixed effect. To do so however requires that unmeasured ability is constant over time and equally valued by different industries. Nevertheless, the results indicate that estimation in first-differences does not significantly alter the importance to be assigned to industry affiliation.

In order to further address the issue of whether inter-industry differentials may reflect competitive returns to unobserved ability Krueger and Summers (1988) also consider the relation between wage premia and rates of turnover. This follows the approach of Pencavel (1970; see section 4.1 below) and the suggestion that if such wage differentials reflect competitive returns then they should not be significantly related to quit rates. Workers in both high and low paying industries would be receiving no more than their opportunity cost of labour. The results of Krueger and Summers (1988) indicate an insignificant negative relation between industry wage premia and quit rates and significant positive relation with job tenure.

More recently Holzer *et al.*, (1991) consider the relation between application rates and inter-industry wage differentials in low wage labour markets. Again the intuition is that if such wage differentials reflect the presence of rents then high wage industries should attract a greater number of applicants. Whilst some evidence exists for such a relation, it is not wholly robust to the inclusion of controls for employer size and union presence.

That inter-industry differentials are merely picking up unmeasured ability is considered by Murphy and Topel (1987). Murphy and Topel (1987) obtain cross-sectional estimates of θ using March CPS data for 1977-84. Strictly, however, Murphy and Topel (1987) classify jobs according to industry and occupational status, rather than controlling for occupation separately. In a wage growth equation, the change in the estimated industry / occupation effect is then included alongside the vector of observables, X.

$$\Delta \ln w_{it} \quad = \quad \alpha + \Delta X_{it}{}' \beta + \delta\, \Delta\hat{\theta}_{it} + \Delta u_{it} \qquad (10)$$

The existence of true industry effects in the cross-sectional earnings equations implies $\delta = 1$, whilst an unobserved ability explanation suggests $\delta = 0$. The estimate obtained by Murphy and Topel (1987) when instrumenting for $\Delta\hat{\theta}$ is 0.29 i.e. on average, individuals who move between industry-occupation classifications receive 29 % of the wage gain predicted by cross-sectional estimates of industry effects.

Two points stand out as potential explanations of the difference in results and why the Murphy and Topel (1987) results may be misleading. First, the classification of status on the basis of an amalgam of industry and occupation status is likely to bias downward the estimate of δ since occupational mobility is much more likely to be determined by unobserved ability. Second, the wage measure employed refers to aggregate earnings for the year as a whole and will confuse that earned in the two different industries for those who switched industry. This leads Gibbons and Katz

(1992) to suggest that the estimate of the change in the individual's industry differential associated in Equation 10 will be downward biased[2] .

Gibbons and Katz (1992) address more directly the issue of unmeasured ability in inter-industry differentials[3] . They consider the issue of whether ability is not equally valued by different industries and hence where learning occurs with regard to unmeasured ability, mobility is not exogenous. The individuals that switch industry are not a randomly-selected subsample of workers. Such circumstances would imply that unmeasured ability cannot be taken to be a fixed effect and hence the estimation results of Krueger and Summers (1988) would be inconsistent. Empirically, the issue is addressed by using the 1984 and 1986 Displaced Workers Surveys (DWS). It is maintained that using data solely on those displaced for reasons of plant closing, slack work or position that was eliminated, corresponds closely to the notion of exogenous job loss and hence exogenous switching between industries. Results indicate that the estimated importance of inter-industry wage differentials remains similar to that obtained on the basis of cross-section earnings equations. The standard deviations of the estimated industry wage differentials on the basis of cross-section and first-differenced for the DWS data are 0.13 and 0.12 respectively.

Gibbons and Katz (1992) also consider an endogeneity issue regarding *to which* industry it is that an individual moves. This is done by regressing the individual's *post-displacement* earnings on the vector of *pre-displacement* individual characteristics and *pre-displacement* industry.

$$\ln w_{it} = \alpha + X_{it-1}{}'\beta + \sum \gamma_j D_{ijt-1} + u_{it} \qquad (11)$$

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2 Murphy and Topel (1987) suggest a correction which leads to a revised estiamte of δ of 0.365 for the IV result. This correction rests on assumptions regarding the distribution of transitions during the year.

3 An alternative approach is adopted by Blackburn and Neumark (1992) who employ test scores as error-prone measures of ability, instrumented by family background variables (i.e. on the assumption that these can be validly excluded as direct directed determinants of earnings). The results obtained suggest that unobserved ability provides only a very modest contribution to the magnitude of inter-industry differentials in the United States.

In this way, it is the impact of pre-displacement industry upon post-displacement earnings which is being considered. The unmeasured ability model would argue that for given pre-displacement worker characteristics, those (exogenously) displaced from high wage industries should have higher post-displacement earnings than those displaced from low-wage industries. Results indicate support for this suggestion in that those displaced from high wage industries maintain a significant differential over those displaced from a low wage industry. Gibbons and Katz (1992) find that the importance of *pre-displacement* industry upon *post-displacement* earnings is between 42 and 47 % as important as the effect of *pre-displacement* industry on *pre-displacement* earnings. However, a positive effect is not inconsistent with a 'true-industry effects' explanation. Gibbons and Katz (1992) estimate that according to such a model the relation between the two estimated sets of coefficients would be 31%. Again the conclusion must be that whilst an endogeneity issue is present it can only account for a fraction of the estimated inter-industry wage variation which remains quantitatively large.

Of further interest in terms of the literature on industry wage differentials is the characteristics of high-paying industries, not least because this may offer further insight into the source of their existence. Whilst this point has been noted above in terms of the relation between wage premia and turnover or application rates, a number of further industry characteristics have been considered by Dickens and Katz (1987)[4] .

Included among these characteristics are industry profitability, product market power (proxied by concentration) and capital-labour ratios which, although not entirely robust across the different papers reviewed, do strongly suggest a positive association with wages. However, even if this does indicate the earning of non-competitive rents it does little to discriminate between efficiency wage theory and bargaining models.

Neal (1993) attempts to consider more directly the efficiency wage proposition that inter-industry variations in wages may reflect industry variations in monitoring technology. To this end, data from the 1977 Panel Study of Income Dynamics is

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4 Katz and Summers (1989) carry out a similar analysis.

employed to consider whether there is evidence of an inverse relation between differences in supervision and wages across industries. No such evidence is obtained. Including controls for frequency of supervision in standard semi-log wage equations does not serve to affect the magnitude of the inter-industry wage differentials.

In the case of Great Britain, Hildreth (1995) provides cross-sectional and longitudinal evidence concerning the magnitude of inter-industry variations in earnings. Hildreth's (1995) results are interpreted as indicating that much of the industry-level variation in pay can be explained as unobserved ability : 75 % of the cross-sectional differentials disappear in the first-differenced results. Concerns may be expressed however, regarding the small numbers of switchers between certain industries and whether those that switch may be said to be randomly selected.

3.2 Wages and Unemployment

An additional aspect of the efficiency wage approach is the notion that unemployment plays a disciplining role upon levels of effort supplied (Shapiro and Stiglitz, 1984). A no-shirking condition then implies an inverse relation between wages and local unemployment since unemployment can, in a sense, substitute for the wage in encouraging employees to supply effort, hence ensuring that the no-shirking condition is satisfied.

The available empirical evidence suggests the existence of such an inverse relation between wages and local unemployment (Blanchflower and Oswald, 1994). Moreover, a remarkable point emerging from this research is the suggestion that the responsiveness of wage-rates to local unemployment is similar across countries. An estimated elasticity of -0.1 is representative of the estimated relationship for a number of countries[5]. In the present context and the issue of interpretation, this remains open, since the inverse relationship is not unique to an efficiency wage approach (see

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[5] However, we should note that results of Blanchard and Katz (1997) appear to question the robustness of this relationship for the United States. Their results, employing weekly and hourly measures of earnings rather than annual measures, indicate a significant role for unemployment but with the appropriate specification appearing to be one between the rate of change of wages and local unemployment.

Blanchflower and Oswald, 1994 and Section 5 below). Whether the evidence may be interpreted in the manner of a no-shirking condition is therefore questionable.

3.3 The Employer Size Wage Differential

The employer size wage effect is one of the most well-established wage differentials observed in the labour market (Brown and Medoff, 1989). Bulow and Summers (1986) claim that this is consistent with an efficiency wage approach where supervision is more costly in large firms which therefore substitute high wages for monitoring. It is argued that this view is also consistent with other related phenomena including that quit rates are lower in large establishments, the existence of more pronounced job ladders at large employers and that the size wage differential decreases with skill level since differences in costs of monitoring are likely to be greatest for less-skilled labour. Whilst the suggestion does suffer from some degree of vagueness and there are a number of competing explanations of the employer size wage effect (see Brown and Medoff, 1989), Rebitzer and Taylor (1995) take this suggestion to be the basis to their analysis of efficiency wages. Rebitzer and Taylor (1995) consider a labour market for lawyers alongside the view that efficiency wages for reasons of imperfect monitoring should not be paid where employees post large performance bonds - since a solution to the incentive problem has already been found. However, the presence of employment rents in large law firms persists. The authors suggest that this may remain consistent with the efficiency wage approach if it is the case that having a job vacancy left unfilled is especially costly for large firms. The performance bond cannot address this form of recruitment issue.

In addition to the possibility that monitoring costs may vary with the size of the employer, they may also differ between types of organisation. This possibility is considered by Krueger (1991). Krueger (1991) examines wages in the US fast-food industry focusing in particular on the difference between company-managed and franchised outlets. It is suggested that monitoring difficulties become more acute in company-owned outlets such that efficiency wage theory predicts higher wage levels in such establishments. This prediction is supported by the data alongside the finding that the tenure-earnings profile is steeper at company-owned outlets. The industry-specific analysis of the effect of monitoring costs upon wage levels represents a relatively clean test of an aspect of efficiency wage theory.

Green *et al* (1996) make the case for a monopsony interpretation to the employer size wage differential with larger establishments or firms being further along an upwardly sloped labour supply curve. This has much in common with an efficiency wage approach since again labour supply to the individual firm is a positive function of the wage rate. Salop (1979) shows that his efficiency wage model where wage premia reduce rates of turnover can be given a monopsony interpretation.

However, as in the case of interindustry wage evidence, information concerning employer size wage effects can only be said to be rather weakly consistent with the approach. The research is perhaps more successful in questioning competitive theory than it is in lending support to efficiency wage models. With this in mind we now turn to consider more direct attempts to assess the merits of the efficiency wage hypothesis.

4 Studies of Performance

The suggested performance-enhancing properties of efficiency wage models indicate that an analysis of performance may lend itself to a consideration of the efficiency wage hypothesis. Such studies tend to differ in their chosen index of performance and hence variant on the efficiency wage hypothesis being considered.

4.1 Labour Turnover

The scope for an employer to reduce employee-initiated separations and avoid the associated labour turnover costs is considered by Pencavel (1970, 1972) at an industry level. Using data on 19 two-digit US manufacturing industries for 1959, Pencavel (1972) finds evidence of a significant negative wage effect upon the rate of turnover, supporting the central hypothesis. Pencavel (1970) obtains qualitatively similar results for 49 manufacturing industries for 1959. (These are a combination of two- three- and four- digit industries). The results indicate that an increase of $100 in earned income will reduce the number of quits by approximately 27 per 1000 employees[6] .

In the case of the UK, similar research, both in terms of approach and results has been carried out by Shorey (1980). Perhaps the main qualification to attach to these results comes in terms of their ability to solve the identification problem. For instance, in Pencavel's (1972) former model, the estimated quits equation involves exclusion restrictions on the proportion of employees covered by collective bargaining agreements and the proportion of employees female. Zero restrictions are imposed on the ratio of urban to total employment and a change in employment term in the (log) wage equation. However, in the case of the quits equation, the urban employment term is insignificant and the change in employment term could be included in the wage equation (e.g. Blanchflower *et al.,* 1990). Excluding the unionism term from the quits equation could be questioned according to the union-voice argument (Freeman, 1980), whilst research tends to indicate that women have higher separation rates than men.

Nevertheless, the research on quit rates is of significance since it also suggests the presence of rent-sharing. Thus, taking the quit rate to be an indication of worker dissatisfaction implies that those industries receiving relatively high wages are in some sense being "overcompensated" at least relative to workers in other industries. As noted above, this becomes important when interpreting research on inter-industry wage differentials.

At a more disaggregated level, Leonard (1987)[7] considers turnover and wages in a sample of 200 single-plant firms. The results are suggestive of efficiency wage considerations in the sense that high-wage firms have lower turnover rates. However, Leonard (1987) notes that the quantitative effect is not strong enough to warrant paying a wage above the market-clearing rate since such a wage-hike would not 'pay

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6 Across the 49 industry sample, mean annual income (standard deviation) is \$4464 (\$842) in 1959.

7 Leonard (1987) notes that at the time of writing, there had been no studies of the efficiency wage hypothesis at the level of the firm.

for itself'. Nevertheless, it can be shown that the introduction of bargaining into the efficiency wage turnover model will result in a reduced wage effect upon turnover. Hence a quantitatively small point estimate of the impact of wages may be a manifestation of the coincident presence of bargaining alongside efficiency wage considerations.

A further firm-level study of quits for the US is carried out by Campbell (1993). The model used essentially restates that of Salop (1979) but goes on to derive anticipated effects of turnover costs and unemployment upon wages as functions of first- and second-order partial derivatives from the quits equation. Empirical analysis using the Employment Opportunity Pilot Project (EOPP) on over 2000 firms provide support for the model to a significant degree - although the anticipated positive effect of turnover costs upon wages may well be merely proxying levels of human capital.

4.2 The Shirking Model

An empirical test of the shirking model is likely to be the most problematic of the studies of performance in the sense that measurement of effort is perhaps the most elusive. Nevertheless, several attempts have been made, typically in the context of estimating a production function model in which effort is taken to be a residual in the production function.

Machin and Manning (1992) attempt to discriminate between alternative dynamic models of worker effort determination based on efficiency wage, bargaining and competitive theories. The estimated model is of the form :

$$\begin{aligned} y_{it} = {} & f_i + \alpha_1 y_{it+1} + \alpha_2 l_{it} + \alpha_3 l_{it+1} + \alpha_4 k_{it} + \alpha_5 k_{it+1} + \alpha_6 w_{it} + \alpha_7 w_{it+1} \\ & + \alpha_8 u^*_{it} + \alpha_9 u^*_{it+1} + \varepsilon_{it} \qquad (12) \end{aligned}$$

where 'y' is the log of value added (measured as real sales); 'l' refers to log employment, 'k' , log capital stock; w is the wage of the firm and u* is alternative utility measured as a convex combination of the industry wage and unemployment benefits. Equation 12 is the empirical approximation to an Euler equation for current effort in terms of future effort, current and future wages and current and future alternative utility. Essentially, an efficiency wage model is derived which predicts a positive relation between current and future wages and effort. It is this positive relation between effort and *future* wages which is the suggested discriminating hypothesis since no relation is anticipated under competitive theory and compares to a negative relation under bargaining. The efficiency wage model also predicts that the coefficients on alternative utility terms should be negative. The results obtained for a sample of 486 UK quoted companies, using company accounts data indicate support for the bargaining model overall. However, on splitting the sample into those firms which principally operate in high versus lowly unionised industries results consistent with the efficiency wage hypothesis emerge for the lowly unionised sample. Caution is urged by the authors in the sense that alternative models may be able to provide predictions with the results obtained. In addition it should be noted that the results reported are for a two-step GMM estimator which has been shown to provide estimated standard errors which are biased downwards (see Arellano and Bond, 1991). Given the levels of statistical significance indicated by the results, this suggests that the statistical evidence cited in support of the efficiency wage model is also not strong.

A similar study to that of Machin and Manning (1992) is that by Wadhwani and Wall (1991) who employ a similar set of data on 219 UK companies for the period 1972-82. Again in the context of a production function setup, Wadhwani and Wall (1991) consider a relative wage and industry unemployment effect upon productivity. Results indicate a significantly positive relative wage effect upon productivity and also consistent with efficiency wage theory, positive unemployment effect. The productivity-unemployment elasticity indicates that firms which operate in industries which experienced a 10 % unemployment increase above the average experienced an increase in productivity of 0.5% above average.

Levine (1992) also carries out an augmented production function-type approach to assess the productivity effects of high relative wages. Results indicate a positive relation between managers' views of relative wages paid to their workers for given skills and changes in productivity by an amount consistent with efficiency wage theories.

Fairris and Alton (1994) focus upon the relation between wages and the intensity of labour effort and the contrasting predictions of efficiency wage and competitive (compensating differentials) models in this context. The two outcomes are taken to be simultaneously determined and estimated by 2SLS. According to efficiency wage theory, the wage term should be significant in the labour effort equation. The results suggest that this is the case. In addition, in the wage equation the intensity of effort term does not attract a significantly positive coefficient, conflicting with the notion of compensating wage differentials. This latter result is not however, out of step with further research into the existence of compensating wage payments.

Cappelli and Chauvin (1991) take as their indicator of effort the dismissal rate at 78 establishments of a car manufacturer in the United States. The hypothesis considered is whether dismissals are lower at plants which offer a wage premium to their employees since according to the shirking model, the cost of job loss is higher. Dismissals are interpreted as an inverse index of the level of effort. The results are consistent with this hypothesis as the establishment wage attracts a significantly negative coefficient in the model for dismissals. One may note however, than an additional aspect of the shirking model concerning the disciplining role of unemployment does not receive empirical support. In addition, the cross-sectional analysis essentially lends support to the view that effort and wages are positively related. However, this same point emerges from the competitive theory of compensating differentials. The analysis does little to discriminate between the two.

4.3 Adverse Selection

The suggestion that a wage premium may offer benefits in terms of the quality of recruited labour is taken up by Holzer (1990) and Holzer, Katz and Krueger (1991). Holzer (1990) uses EOPP data for 1982. Estimation results by 2SLS suggest that benefits of wage premia include lower costs of recruitment (i.e. hiring time and training time). In addition, wage premia are positively associated with managers' perceptions of worker productivity. They are negatively related to job vacancy rates. Whilst these effects are not individually quantitatively strong, results suggest that they are stronger when firms have elected higher wages voluntarily as opposed to being bargained by a union and collectively may offset more than one-half of the direct financial costs of higher wages.

Holzer *et al.*, (1991) consider application rates to firms and their relation with, inter alia, the wage rate focusing in particular on low wage jobs. Again this uses data from the EOPP survey and estimates via 2SLS given that wages and application rates are likely to be jointly determined. Results suggest the payment of an above market-clearing rate minimum wage is associated with higher rates of job applications compared to both wages at levels slightly below and slightly above the minimum wage. The latter may be rationalised on the grounds that employers whose wages were below the minimum wage before its imposition but whose differential reflected non-pecuniary job attributes will find that after raising their wage to the minimum level in line with minimum wage legislation they will experience relatively higher application rates. In addition, results indicate that job applications per opening are relatively high in the cases of large firms, unionised firms and firms in high-wage industries, suggesting the enjoyment of rents in such circumstances. Nevertheless, the relation with high versus low wage industries is not especially strong (particularly when controlling for establishment and firm size) and Fairris and Alton (1994) cite this point to suggest that the results question the notion that high wage industries do reflect efficiency wage differentials rather than compensating payments. The issue of the quality of job applicants is not addressed.

4.4 Sociological Model of Gift Exchange

In its consideration of the psychology of the workplace, the gift exchange model represents the form of the efficiency wage hypothesis which departs most markedly from conventional theory. As expressed by Akerlof and Yellen (1990), fairness takes the form of the level of the actual wage relative to what the employee considers to be just. Alongside this conception of fairness is a relation with effort supplied on the job.

If this 'fair wage' is assessed by reference to that wage enjoyed by other workers in similar circumstances, the model predicts that comparison income enters the utility function of employees. In addition there is the strong suggestion that ability to pay also factors in the worker's assessment of the fair wage.

However, that a variable enters the utility function of workers[8] is not sufficient to guarantee that it will be considered by employers in wage-setting nor, a fortiori, that it enhances performance. The second tranche of evidence which offers some support for the sociological model therefore comes in the form that wage comparisons matter for wage determination. Of course bargaining theory also suggests that the outside option impinges upon the negotiated wage outcome such that any empirical analysis must attempt to discriminate between the two rationales. Smith (1996) makes an attempt to do this by suggesting wage leadership by a major producer in an industry as representing comparison income rather than an outside option which might be expected to correspond more closely to an average of all related producers. Empirical evidence which supports such wage leadership in the chemicals industry by the major producer, ICI, is therefore argued to be consistent with the comparison income rationale for wage interactions rather than as a fall-back option. In terms of its relevance for efficiency wage theory, the contention that this is performance-enhancing is left untested but if firms are profit maximising could not such wage interactions only be offered by firms if it was in the interests of the employer to do so?

Nevertheless, of relevance here and cited by Akerlof and Yellen (1990) in support of the argument are a number of psychological experiments. In controlled environments it appears that individuals' levels of output are decreasing in the levels of wages received by others or in their own previous wage. This is most often rationalised in terms of equity theory (Adams, 1963) arguing that perceived values of inputs and outputs will be balanced by agents engaging in exchange.

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8 Evidence that comparison income matters for workers' levels of job satisfaction is provided by Clark and Oswald (1996).

4.5 *Union Threat Model*

The scope for workers to bargain a portion of the employer's surplus suggests the firm may follow a union-avoidance policy of offering a wage above the reservation wage of workers. Dickens (1986) models this incentive for firms to offer above market-clearing wages and in so doing obviate the motive for workers to become organised.

The notion that union sector outcomes may impinge upon the non-union sector via a threat effect is well established. Dickens (1986) argues that the model may also be more consistent with certain stylised facts which alternative efficiency wage models have difficulty in explaining. In particular, there is the point that the inter-industry wage differentials noted earlier are highly correlated across occupations. This occurs despite the anticipated differences in monitoring and turnover costs between these occupations. Dickens (1986) maintains that the union threat model can account for this point since all wages in the industry depend upon common profits per worker. At a conceptual level, the degree to which the Dickens' (1986) model corresponds to an efficiency wage rather than bargaining model is not immediately clear. Although it is in the employer's interests to avoid union organisation, it is ultimately due to the presence of bargaining that this is the case.

The most general attempt to consider the implications of efficiency wage theory in a performance equation is that by Konings and Walsh (1994) who consider the relation between wages and product market performance of firms. Thus rather than taking a specific measure of performance on the basis of one particular model of efficiency wages, the analysis proceeds by examining a general index of performance (market share). A main comment of Konings and Walsh (1994) concerns the fact previous studies have been generally unable to suggest that wage levels above market-clearing rates are able to 'pay for themselves'. Using UK company level panel data, the empirical evidence finds a positive relation between wages and market share performance in firms within lowly unionised industries. This is interpreted as evidence of firms voluntarily paying higher wages as a means to improving their product market performance.

As should be clear from the discussion thus far, the major difficulty in attempting to provide evidence for efficiency wage theory, has been one of observational equivalence. In this respect, two additional means of discriminating between hypotheses suggest themselves in the form of experimental and survey evidence.

The importance of holding other things constant in order to provide a cleaner test of some hypothesis might be considered to be the strength of experimental studies, particularly when in an econometric model it is difficult to control for such factors adequately. Fehr *et al.*, (1996) adopt this approach in an attempt to consider the strength of the efficiency wage hypothesis and a number of its implications. Thus in fixing the worker's reservation wage, it becomes possible to consider both whether employees earn job rents (non-compensating wage differentials) and the existence of involuntary unemployment. In addition, underlying these outcomes should be several behavioural relations including a reduction in shirking resulting from a wage increase. This reduction should be sufficiently strong such that higher wages lead to increased profits.

The experimental results support the qualitative aspects of efficiency wage theory : higher wages reduce shirking; non-compensating wage differentials exist; involuntary unemployment is present as some individuals do not receive job offers. Generally however, the quantitative predictions do not receive full support. In particular, shirking persists despite the parameterisation of the model which predicts that this should not be the case.

Turning to survey evidence, this too provides support for aspects of efficiency wage theory. Blinder and Choi (1990) find evidence for both an ability to pay effect and the importance of maintained differentials within the firm - in the face of changing patterns of demand and supply which, according to competitive theory, would render such differentials unprofitable. However, it is questionable whether an ability to pay effect can be cited as evidence in favour of any efficiency wage model. It is likely to be most consistent with a bargaining model. Agell and Lundborg (1995) also provide survey evidence in this case for Swedish Manufacturing. Their results also offer support for efficiency wage theory. Relative wages and fairness are cited by a majority of firms as being among the most important concerns by personnel managers.

5 Wage Bargaining

The competitive, market-clearing approach to wage determination in which workers are paid their reservation wage which reflects levels of human capital is also questioned by the bargaining approach. At a general level, this literature regards the competitive approach as incomplete in the sense that wage determination is viewed as reflecting a combination of inside (employer-level) and outside (market-level) forces, with ability-to-pay taking on a prominent role as an influence upon wage levels (see Oswald, 1995). In contrast, competitive theory maintains that there is a going-rate for a given level of human capital, independent of the employer's ability to pay.

The standard presentation of the bargaining model (see for example Carruth and Oswald, 1989) considers the solution to the following Nash bargain :

$$\Omega = \left\{\left(U(W) - U(\overline{W})\right)N\right\}^{\beta} \pi^{1-\beta} \tag{13}$$

to be maximised over the wage, W where U (.) denotes the union utility function, w-bar the level of income available during a temporary dispute; π represents firm profits, N the level of employment and probability of employment.

The solution to Equation 13, which assumes a risk neutral, utilitarian union in which layoffs are decided randomly, may be derived as :

$$W = \overline{W} + \left(\frac{\beta}{1-\beta}\right)\frac{\pi}{N} \tag{14}$$

Thus the equilibrium wage is given by the outside temporary income, $\overline{W}$, (which may in turn be considered to be a function of some wage available in another sector of the economy, the level of benefits and unemployment rate) and some fraction of profit-per-worker, this fraction reflecting the relative bargaining strengths of union and firm. This solution is independent of whether employment-setting also lies within the scope of the Nash bargain, as in the case of efficient bargaining, or is instead set by the employer according to the labour demand curve.

Hence, the role of the local unemployment rate, considered by Blanchflower and Oswald (1994) emerges in the bargaining model as reflecting the probability of obtaining benefits rather than the competitive wage. This represents an important issue, not least because competitive theory in the form of the Harris and Todaro (1970) model would argue that individuals are compensated for residing in high unemployment areas where the anticipated costs of job search are higher. Thus the finding of an inverse wage-unemployment relation would appear to run counter to this aspect of competitive theory. Rather than being compensated for residing in a high unemployment region, wages and unemployment appear to be negatively related. According to the bargaining model, in regions with high rates of unemployment, any temporary dispute would render employees less likely to obtain a wage in some alternative sector not subject to the dispute, which in turn places downward pressure on the wage bargain with the current firm.

In Nash bargaining models of this type, bargaining strength β is typically taken to be an exogenous parameter reflecting rates of time preference. Nevertheless, in certain studies such as that of Svejnar (1986) it is considered as an estimable function of several variables including the unemployment rate. In this approach the unemployment rate also "weakens workers' bargaining power and thereby reduces the share of profits that those workers can appropriate" (Blanchflower and Oswald, 1994; p.83).

However, not surprisingly most of the bargaining literature has focused upon the ability-to-pay relationship with wages. In the following section we provide a brief, and selective, review of such studies (see Oswald, 1995; Sanfey, 1995, for more complete treatments).

5.1 *Ability-to-Pay in Wage Determination*

The bargaining approach on which these studies focus, have attempted to employ micro-data in order to consider the existence of rent-sharing in both unionised and non-unionised labour markets. We focus upon those studies which employ data for Great Britain, and where relevant refer to non-British studies.

One of the first attempts to employ microdata in order to consider the bargaining model outlined earlier is that by Denny and Machin (1991)[9]. The study represents an attempt to respond to Carruth and Oswald's (1989) suggestion of the desire to employ microdata in order to examine the relation between wages and ability-to-pay as well as the critique of Pencavel (1990). Denny and Machin (1991) estimate a company-level wage equation of the following form :

$$w_{it} = \alpha_i + \delta w_{it-1} + \gamma_1 \left(\frac{\pi}{N}\right)_{it-1} + \gamma_2 \overline{w}_{it} + X_{it}\beta + \psi_t + u_{it}$$

where w_{it} denotes the log of the average company wage in firm i, at year t; $(\pi / N)_{it-1}$ represents lagged profit per employer, $\overline{w}$, the log average wage prevailing in industry j; X is a vector of additional explanatory variables including the firm capital-labour ratio and industry union density; α_i denote firm- and ψ_t time- specific effects. The relevant data is derived from the company accounts of 436 companies and the period 1979-86. Denny and Machin (1991) find evidence of a significant relation between the average company wage and profit-per-worker, with an elasticity of 0.01.

A similar study which also takes its motivation as being in the form of a bargaining model is that of Nickell and Wadhwani (1990). The paper does not consider the role of profit-per-worker (but comments as a footnote that such a term was found to be insignificant) considering instead the role of several variables which

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9 A time-series study of wages and (lagged) profitability is carried out by Carruth and Oswald (1989). Blanchflower *et al.* (1990) use cross-sectional data, finding evidence of financial performance effects upon wage levels with Beckerman and Jenkinson (1991) employ industry level panel data arriving at similar qualitative conclusions.

might be considered to be related to ability-to-pay, including revenue-per-worker. Results include a significant revenue-per-worker effect, although the lagged value appears with a negative coefficient. Recovering an estimate of the insider weight from their estimated bargaining model produces an estimate of 0.11, with further results including a negative influence of (aggregate) unemployment upon average company pay and the suggestion of an unemployment composition effect resulting from the proportion of long-term unemployed. The results indicate that the for a given level of unemployment the greater the proportion of long-term unemployed, the higher the level of wages. This is consistent with the view that the long-term unemployed represent less effective job seekers[10].

The use of company accounts panel data is continued by Nickell and Nicolitsas (1994) who also employ data from the CBI survey of wage settlements. The data covers 66 firms and the period 1979-86 (with relatively few firms post-1982). The sample size therefore appears relatively small compared to several of the previous papers. The paper estimates equations for the determination of firm productivity and restrictive practices as well as wage levels. Thus an interesting feature of the Nickell and Nicolitsas (1994) paper is that since bargaining also occurs over effort, the associated restrictive practices which lower levels of effort, might also be considered to represent a form of rent-sharing. Their estimation results for productivity indicate a positive effect resulting from relative wages at the firm (consistent with efficiency wage theory) and negative effect resulting from restrictive practices. The estimated company-level wage equations indicates that wages are positively related to profit-per-worker and market share, with a proxy for the shock experienced in the 1979-81 recession (based on the fall in employment) entering significantly negative. An (inverse) measure of ability-to-pay in the form of the company borrowing ratio is negatively signed and statistically significant. Further,

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10 A similar analysis to that of Nickell and Wadhwani (1990) is conducted by Nickell *et al.* (1994). The paper finds evidence of significant product market power (proxied by market share) effects upon firm-level wages. It is estimated that a 1% increase in the wage will follow from a 13% increase in market share.

the removal of restrictive practices is negatively related to profit-per-employee and a positive function of the burden of debt.

Hildreth and Oswald (1994) employ both a company and establishment-level panel in order to consider the proposition that workers share in employer rents in Great Britain. First however, Hildreth and Oswald (1994) make the important point that a relation between wages and profit-per-worker is not sufficient evidence of rent-sharing since it may reflect the coincident impact of demand or price shocks upon wage and profit-levels[11]. This will be the case if the firm faces a positively-sloped labour supply curve. Intuitively, the firm 'moves up' its labour supply curve following a positive demand shock. Hildreth and Oswald (1994) find evidence of significant effects from profit-per-worker to the average wage at lags of upto t-6, consistent with the rent-sharing hypothesis. Moreover, their also appear to be similar ability to pay effects present from total profits. This addresses the objection that a positive relation (which may be spurious) could be obtained on the basis of using total wage bill data which is then regressed on a term normalised on the number of employees. The estimated elasticity of wages with respect to profit-per-worker is estimated at 0.02.

An important aspect of the paper by Van Reenen (1996) is the argument that a context is found which comes close to attaining the conceptual experiment ideal of subjecting a subsample of firms to an increase in rents whilst allowing comparisons to a control group. Such a context, it is argued, is to be found where firms undertake investments in research and development, only a fraction of which bear fruit. Moreover, Geroski *et al.,* (1993) using a related panel of firms find that innovation leads to a significant increase in profits with margins rising by 6.2 % relative to the mean in the long run. More specifically, Van Reenen (1996) merges company accounts panel data with an industry-level (at the two-digit level) source of data on counts of innovations. Van Reenen (1996) finds strong effects from ability-to-pay to

11 Blanchflower *et al.* (1996) derive the natural result that if the elasticity of labour demand is less than one then such a positive relation with total profits will also be reflected in a positive relation with profit per worker. Estimates in Hamermesh (1993) suggest that the elasticity of labour demand is indeed likely to be less than unity

average employee pay in a panel of 598 companies and the period 1978-82. The elasticity of the average employee wage with respect to quasi-rents, defined as the revenues per-worker less the average industrial wage, is estimated at 0.23. Similar results are also obtained for a profit-per-worker variable and a measure of ability-to-pay in the form of Tobin's Q. The paper is related to the contribution of Abowd and Lemieux (1993) which considers Canadian collective bargaining agreements over the period 1965-83. The relatively large effects found by Van Reenen (1996) are also in evidence in the results of Abowd and Lemieux (1993) with estimated elasticities of approximately 0.26[12] . Such large elasticties are obtained when employing (external) instruments for the wage in the form of import and export prices. This is in line with their discussion which makes clear three potential sources of bias in least squares estimation of profitability effects upon wage levels. First, that resulting from the fact that profits are inversely related to wages in any standard profit function. Second, if the rents variable is measured with error this will also impart bias to least squares estimates. Finally, the degree of bargaining strength of employees may be a function of the volume of rents available and hence differ across firms. The first two forms of bias may be addressed by the use of IV estimation with Abowd and Lemieux (1993) showing that the third potential source of bias may be allowed for by the addition of a quadratic term in rents to the estimating equation alongside estimation by IV methods (This assumes that the bargaining strength parameter is a linear function of the volume of rents). As noted above, Abowd and Lemieux (1993) find much stronger ability-to-pay effects which are markedly greater than those reported in the related study by Christofides and Oswald (1992) also using Canadian contract data.

The final related paper on which we comment is that by Smith (1996b). This paper is notable for its finer attention to the bargaining environment, in the context of the UK chemicals industry. In particular, the paper considers the determination of bargained wage agreements in over 100 bargaining units and the period 1981-89. The paper contains a number of advantages in terms of measurement issues, in particular relative to the company accounts panel data models discussed previously. A basic

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12 Oswald (1995) notes that an upward correction to this elasticity is in order (in the long-run solution) given the presence of a lagged dependent variable in the estimating equation.

wage of a given type of worker is used as the dependent variable which more closely corresponds to the subject of wage negotiations, uncorrupted by potential skill composition changes. The paper also empirically refines the notion of alternative options with data on total stocks and liquid assets. The results indicate significant positive effects from profit-per-worker to the wage measure. The preferred estimates indicate that a 10% increase in profitability raises wages by 4%. Wages are also relatively higher where firms are relatively capital intensive and lower where firms hold greater inventories. Nevertheless, a number of findings appear at variance with what one might anticipate, a priori. The total stocks variable is further disaggregated in terms of stocks of finished goods, work-in-progress and raw materials with the estimated total stocks effect being driven by the significance of the raw materials variable. This would appear to be at odds with the notion of the stocks variable as representing an enhanced ability to "buffer the firm against the effects of a strike" since this role would be better reflected in the stocks of finished goods. Smith (1996) does not find evidence of a significantly negative local unemployment effect upon pay, in contrast to the 'empirical law' of Blanchflower and Oswald (1994). We should also note that the paper remains open to the argument of Hildreth and Oswald (1994) that a relatively short-run relation between wages and profit-per-worker (despite being instrumented) may reflect short-run labour supply frictions and the effects of demand shocks.

In sum, there is now a progressing body of literature which suggests that employee pay is raised under conditions of employer prosperity. We now turn to a brief discussion of the way in which to interpret such findings.

The discussions based on regression models in which employer profitability is entered as a regressor typically centre on the notion of bargaining derived from a Nash bargaining model, such that as a result employees are able to enjoy earnings in excess of the alternative by sharing in the per worker rent. The game-theoretic basis to the Nash solution of the bargaining problem is based on a game of alternating offers in which a surplus of fixed size is to be divided among the two interested parties, say firm and union. The division of the surplus reflects the relative rates of time preference of the two parties as well as which moves first. The case for such bargaining to extend to the non-union sector has been widely made (e.g. Lindbeck and Snower 1987, Pencavel 1991) and may result from the costs associated with replacing the incumbent workforce with outsiders (see Shaked and Sutton, 1984, for a game-theoretic treatment). This confers a degree of bargaining strength to those employed in the sense that the employer cannot costlessly replace them with outsiders.

Although noted in several instances, there are other rationales for profitability to matter for wage determination, even as a long-run phenomenon. This is made quite clear in Christofides and Oswald (1992) where the intention is to consider a 'family' of models rather than attempt to test between them. Included in this class of models are efficiency wage models, union bargaining models and the related insider-outsider models. These approaches are collectively referred to under the label 'rent-sharing'.

An additional basis for profit-per-worker in influencing wages is acknowledged by Carruth and Oswald (1989) resulting from equity theory. Thus firms may surrender a fraction of any surplus to its employees on the grounds that to do so conforms with sociological norms of behaviour. However, if it is the case that what is at work here is that workers require a pay rise following an increase in firm profitability because otherwise they would feel disenfranchised then this describes a compensating wage differential for such conditions. Employees are not therefore enjoying rents. This point is made by Pencavel (1990). Carruth and Oswald (1989) refer in some detail to how fairness may provide a basis to an empirical model which enters profitability in a wage equation, but as Pencavel (1990) makes clear if this is the rationale then it may be quite unrelated to a model of bargaining.

The connection between equity theory and efficiency wage theory is developed by Akerlof and Yellen (1990). Akerlof and Yellen (1990) also refer to the psychology literature which indicates a role for reciprocity and notions of fairness in determining effort levels. In placing greater emphasis upon the implications for levels of effort supplied, the approach does deviate from competitive theory since under a compensating argument, the payment of the differential is such as to prevent the employee from leaving the firm. Cost minimisation involves the payment of a positive differential where the firm is relatively inefficient at economising on the production of some non-wage job attribute which enters a worker's utility function negatively. Naturally this non-wage attribute of work may be the level of effort. As such, it is not to say that levels of effort and wages will not also move together according to competitive theory - they will, but the direction of causality does not run, as is the case under efficiency wages, from the wage to the level of effort. The argument of Akerlof and Yellen (1990) which cites equity theory as a basis to efficiency wages does distinguish the approach from a competitive approach.

Equity theory may also be related to the general suggestion that certain employers may wish to be perceived as 'good' employers and for this reason pay wages above market-clearing levels. Such notions, related to expense preference, appear as a rather slippery concept and deviates from profit maximisation.

Thus despite being commonly derived on the basis of a bargaining model, which may be considered a competing approach to that of efficiency wages, it is worth restating the point of Carruth and Oswald (1989) and Christofides and Oswald (1992) that the associated empirical studies appear more successful in questioning the competitive model rather than discriminating between alternative approaches within this class of rent-sharing models.

Aside from matters of interpretation, there is the further issue of measurement of these 'rent-sharing' effects. Something of a controversy appears to have emerged in terms of the quantification of the profitability effects upon pay. Oswald (1995) describes how the results of Abowd and Lemieux (1993) and Van Reenen (1996) appear to imply that profitability accounts for more variation in wages that is actually present in their datasets. In contrast, the relatively small elasticity values, such as those obtained by Hildreth and Oswald (1994) continue to indicate that profitability effects are quantitatively important and at the same time may be more plausible. In reviewing the literature, Oswald (1995) cites Lester's range of wages for reasons of rent-sharing as a summary statistic of the influence of rent-sharing in the determination of wages[13]. One may question the basis on which this is done. Panel data regression estimates in first-differenced models essentially describe time-series

13 $L = 4\eta\frac{\sigma_{\pi}}{\bar{\pi}}$, where η denotes the elasticity of wages with respect to profit-per-worker; σ represents the standard deviation of the profit series and $\bar{\pi}$.

effects for the set of companies whereas the dispersion in the rents variable, measured by its standard deviation, largely reflects inter-company differences in profits, with significant degrees of persistence to profits for individual companies. Thus the employed standard deviation for the summary statistic is likely to overestimate the variation in profits which individual companies will experience. Time-series effects are being interpreted in a cross-section fashion and as Nickell *et al.* (1994, footnote 9) comment, where cross-sectional differences in the value of a variable are much greater than the time-series variation, this should be done with caution.

The argument is related to the view of Abowd and Lemieux (described in Oswald (1995)) who warn against the use of this summary statistic for reasons of measurement error in the profits figures. The two are related since much of the measurement error in profit data is likely to be constant for individual companies and hence is controlled for in fixed effects regressions of company profitability which reveal significant persistence. The implication of this line of argument would appear to be that those studies which find relatively large elasticities should not be discounted on the basis of being implausible.

In the light of the discussion in terms of efficiency wage and wage bargaining literatures it seems natural to consider the scope for combining the two approaches. A limited literature has considered whether on attempting to combine the two approaches, the two sources of wage premia reinforce one another. The model of Lindbeck and Snower (1991) suggests that they do not. The influence of insider power reduces the incentive of firms to pay a wage premium for efficiency wage reasons. Sanfey's (1993) two-sector model obtains the converse result. One weakness of the analyses refers to the fact that neither of the two models allow effort to enter the utility function of employees directly. This combination of efficiency wage and bargaining approaches is likely to provide interesting scope for future research.

6 Concluding Remarks

A synopsis of the empirical efficiency wage literature reviewed in the present Chapter might suggest that on balance the econometric evidence generally offers results consistent with efficiency wage theory - whilst encountering difficulty in discriminating between alternative hypotheses for the existence of non-competitive rents. Complementary to this econometric evidence, and perhaps providing strongest support for efficiency wage theory, has been the results of experimental and survey evidence, albeit as yet limited in number.

The impression should not be gained however, that different models of wage determination are *competing* or mutually exclusive explanations of the same issue. Although often couched in such terms for the purposes of empirical work, this is not the case. Different forces of wage determination may be superimposed upon one another. It is not least the suspicion that this is likely to be the case that has contributed to the difficulties of interpretation noted above.

However, in differing circumstances the importance of different approaches is likely to vary. Indeed this provides us with our most constructive point for future empirical work. In order to address the issue of observational equivalence, empirical analysis should attempt to consider whether the circumstances suggested by the theory correspond to those observed in practice. Of course, theory should lead empirical work and in this respect has a further necessary contribution to make in highlighting such circumstances. Relevant considerations here are likely to be the degree of worker liquidity, risk aversion of workers and employers and the ability of the employer to make commitments. Thus far, these factors have not been modelled explicitly. Nevertheless, microeconomic evidence concerning bargaining and in particular, with regard to the efficiency wage hypothesis is still in its early stages and largely confined to the United States. In the light of this, scope for development is clear. The weight of evidence reviewed here is nevertheless encouraging, in terms of suggesting the existence of non-competitive wage premia.

Chapter 3

Inter-Industry Wage Differentials in Great Britain

Abstract : The Chapter considers the determination of earnings of private sector employees in Great Britain, focusing upon the importance of industry affiliation in this process. Whilst cross-sectional estimates, using waves 1 and 4 of the British Household Panel Survey, suggest industry status is of considerable importance, much of this variation is removed by estimating earnings equations by fixed effects methods. Estimated differentials are not inversely related to the steepness of age-earnings profiles in an industry, as competitive theory might predict and, in cross-section but not in differences, are positively related to industry profitability.

1 Introduction

The importance of, and level of interest in, inter-industry wage differentials stems both from their role in accounting for the structure of wages in general, but also in providing a context for considering competing theories of wage determination. In this sense, wage differentials according to industry status are perhaps unique. Wage differentials by industry affiliation may account for differences in earnings across individuals at a moment in time, in the same way as other differentials observed in the labour market, but may also offer some insight into the more fundamental forces at work in determining a particular earnings distribution. In particular, evidence on the existence and importance of industry effects has tended to be seen as an indirect test of market-clearing theories of wage determination. According to competitive theory, the implied law of one price dictates that contingent on unobserved human capital and job attributes, persistent inter-industry wage differentials cannot exist. The present Chapter takes an interest in these issues as its motivation for estimating inter-industry wage differentials and offers such estimates for Great Britain, based on both cross-section and longitudinal data. Further, we attempt to provide additional insight into the nature of these estimated differentials by considering their relation with a number of industry characteristics including the returns to experience by industry and industry profitability. This allows us to assess the empirical merit of what is the most natural non-competitive explanation for the existence of such differentials - that they result from inter-industry variations in ability-to-pay.

The rest of the Chapter is organised in four main sections. Section 2 outlines the estimation issues which arise in any analysis of ceteris paribus, inter-industry wage differentials. Section 3 selectively reviews the previous literature which exists, mainly for the United States. Results obtained, employing data from the British Household Panel Survey, and matched financial data from company accounts are presented in Section 4. Concluding remarks are offered in Section 5.

2 The Estimation of Inter-Industry Wage Differentials

In the estimation of inter-industry wage differentials, the conceptual experiment which we have in mind and which the empirical analysis is designed to be as close as possible to attaining is to draw one individual at random from one industry and randomly select another industry to which he / she is to move, observing the resulting change in wage. The observed change in wage is the ceteris paribus industry wage differential.

A number of issues arise in attempting to obtain an estimate of this ceteris paribus wage differential. The description noted above places an emphasis upon the time-series variation experienced by individual cross-section units as they switch between industries. It seems natural therefore to think in terms of panel data (specifically, fixed effects) estimates. Nevertheless, one would expect cross-sectional evidence to shed significant light on the same underlying processes, contingent upon the quality of data at hand and in particular the ability to control for factors which may be related to both wages and industry affiliation. The cross-sectional wage equation may be considered a special case of the estimating equation :

$$\ln w_{it} \quad = \quad \alpha f_i + X_{it}{}' \beta + \Sigma\theta_j D_{ijt} + u_{it} \tag{1}$$

where 'i' indexes individuals, the 'j' subscript an industry, and 't' time periods. w_{it} refers to the wage, X_{it} represents a vector of demographic characteristics and D_{ijt} is a set of industry dummies. In the cross-section analysis $f_i \equiv 1$, $\forall$ i and are thus not identified. To the extent that ability, which one would clearly expect to influence wages and which is only imperfectly measured in the set of human capital variables, is related to industry affiliation then the coefficients on industry status, θ_j, are biased upwards, and will be picking up an unmeasured ability effect. This assumption may be relaxed by the use of panel data on individuals such that unobserved ability may be represented by the inclusion of the individual-specific terms, f_i.

Nevertheless, the estimation of cross-sectional earnings equations represents the natural starting point for the analysis of industry effects in determining wages. Evidence of a significant, persistent cross-sectional relationship between industry affiliation and wage levels (see Section 3 for a review) meets with two potential objections. First, these may represent compensating differentials for undesirable aspects of work in such industries. Workers in such industries would therefore continue to earn their opportunity cost. However, the addition of further controls for compensating payments into the estimating equation does not typically reduce the importance of industry. In addition it is perhaps also worth noting that direct evidence into the payment of compensating differentials is rather mixed. The degree of importance attached to industry status therefore renders a compensating differentials explanation unlikely.

Second, and the point which represents the main source of debate concerning the existence and magnitude of inter-industry wage differentials, is the extent to which they may reflect unobserved attributes of workers and in particular unobserved ability, related to both earnings and industry.

The ability to control for unobservables represents a prime advantage of panel data techniques. Hence, as noted previously, it is argued that the use of longitudinal data allows one to control for those time invariant factors that are specific to each individual. Thus differencing of Equation 1 produces :

$$\Delta \ln w_{it} \quad = \quad \Delta X_{it}{}' \beta + \Sigma \theta_j \Delta D_{ijt} + \Delta u_{it} \qquad (2)$$

such that on differencing, the influence of unobserved ability, assuming it to be a fixed effect, disappears from the estimating equation and any correlation between ability and industry affiliation is purged from the analysis.

However, issues continue to arise in the estimation of inter-industry wage differential from panel data and the attempt to obtain estimates which correspond to the ideal of the conceptual experiment.

Given the description of our conceptual experiment, it becomes immediately clear that non-random selection of those who are to move industry and / or of the industry to which a given switcher moves, will give rise to biased results and flawed inferences.

The problem of endogenous selection of those who switch industry renders the fixed effects characterisation of the unobservables incorrect. In the context of estimating inter-industry wage differentials, the ability to treat unobservables as fixed effects rests on two key assumptions. These unobservables, which for clarity we refer to as unobserved human capital, must be constant over time for individual workers and rewarded equally by different industries. Thus if 'learning' occurs regarding unobserved human capital and individuals switch in order to match with a higher-paying industry, unobserved human capital is no longer a fixed effect (Gibbons and Katz, 1992). The same point arises in the estimation of union wage differentials from panel data and is considered by Stewart (1983; see also Freeman, 1984)[1]

In terms of our own analysis, we do not attempt to offer any explicit treatment of this issue but instead note that the cross-sectional results are more robust to any bias resulting from non-random selection of those that switch status between waves. Unlike Gibbons and Katz (1992), we do not have access to data which may be considered to represent exogenous job loss for Great Britain. Any attempt to correct for non-random selection by, say, carrying out a Heckman (1979)-type correction would be problematic requiring convincing identification restrictions[2] The method adopted by Stewart (1983) would not seem appropriate when there are more than a very small number of sectors across which variation in the sectoral dependence of omitted characteristics can occur.

It is also worth noting that in terms of the quantitative effect of allowing for non-random selection, the results of Gibbons and Katz (1992) indicated that the more

1 Solon (1988) further discusses this issue.

2 In principle, it is possible to achieve identification without imposing exclusion restrictions but instead exploiting the fact that the included Inverse Mills Ratio term represents a non-linear function of the variables (resulting from the non-linearity of the estimated probit model) while the estimated parameters are (assumed to be) linear functions of the included regressors. Exploiting non-linearities for identification purposes is not recommended however, since it assumes a very high level of confidence in the assumed functional form.

significant issue was that of the particular industry to which a given switcher moves. We address this issue empirically.

In employing a sample of individuals whose reason for job loss can be (approximately) taken to be exogenous, Gibbons and Katz (1992) therefore address the former of the two potential endogeneity issues noted above. In itself, this does not however, address the point concerning the suggestion that for given job loss, those with higher unobserved ability may move to industries where ability is more important and more highly rewarded. Instead, this issue is addressed by Gibbons and Katz (1992) by using the pre-displacement explanatory variables alongside the post-displacement wage. It is maintained that according to the unobserved ability explanation, for given pre-displacement characteristics, workers displaced from high wage industries will maintain an earnings advantage (post-displacement) over those displaced from relatively low-paying industries. The difficulty that arises however refers to the fact that a relation between pre-displacement industry and subsequent wage under a 'true industry effects' explanation "depends crucially on the process by which (potentially rationed) jobs in high wage industries are allocated" (Gibbons and Katz, 1992, p. 528). Thus in the empirical analysis presented in Section 4 we argue that a more appealing consideration of this potential endogeneity issue is to allow the industry effect to vary between those who join and leave an industry and test the hypothesis that these effects are equal in magnitude and opposite in sign. A strong case can be made for the argument that failure to reject the null hypothesis implies that one is observing a ceteris paribus differential.

Clearly, an additional factor which would give rise to problems would be if there is error in reporting a change of industry when no such change has taken place. Such measurement error becomes more problematic in the context of panel data studies vis a vis cross-sectional analysis since in the former case there exists a higher proportion of observations in error (with the signal-to-noise ratio correspondingly lower) given that it is the changers that 'provide the mileage' to the estimation method (see Freeman, 1984).

In the same vein as Gibbons and Katz (1992) we do not attempt to model this potential issue directly. We note that the main source of measurement error encountered by Krueger and Summers (1988) is likely to result from the fact that their

CPS data is not able to match individuals who change address during a survey year. This involves the loss of 30 % of respondents, who are likely to have a higher propensity to have switched industry (Keane, 1993). Our own dataset continues to sample those who change address and is rather successful in avoiding attrition from this source (see Taylor *et al,* 1995, Volume A). The fact that cross-sectional studies are less sensitive than first-differenced estimates to measurement error, also suggests attaching more weight to the cross-sectional estimates for this reason.

The estimation issues described in this section have served to direct the empirical research undertaken into inter-industry wage differentials. This will become clear as we now go on to describe the available empirical literature on inter-industry wage differentials.

3 Previous Studies of Inter-Industry Wage Differentials

An important early contribution into the nature of the wage structure by industry affiliation, which anticipated much of the subsequent analysis, was made by Slichter (1950) commenting on the apparent degree of regularity in the inter-industry wage structure. Alongside evidence of marked stability in this inter-industry wage structure, Slichter (1950) also illustrated the high correlation in inter-skill group earnings by industry in addition to the positive correlation between earnings and profitability. Earnings also appeared to be somewhat higher in industries where labour costs were relatively small relative to sales revenue. In a sense therefore, Slichter (1950) anticipated the more recent research into inter-industry wage differentials using micro-data, and had also concluded that the competitive model was unlikely to provide an adequate explanation of these relations. Interestingly, Slichter (1950) placed greater emphasis upon "managerial policy" as a determinant of wages.

The starting point for the analysis of inter-industry wage differentials taken by Krueger and Summers (1988) is the argument that under a competitive theory, a law of one price prevails such that workers of equal quality receive equal rewards. In contrast, admitting the likelihood that forms of monitoring technology or turnover costs are likely to vary by industry, suggests the presence of inter-industry wage differentials according to efficiency wage theory.

The estimated wage equations of Krueger and Summers (1988) include the standard human capital and demographic controls with the main summary statistic on the importance of industry affiliation being the employment-weighted standard deviation of the industry dummy coefficients. The cross-section results indicate that this is approximately 15 per cent. Consideration of the stability of these differentials over time then lends weight to the view that these differentials persist and do not reflect transitory shocks. The correlation of the estimated industry wage effects for 1974 and 1984 is 0.97.

Such persistent inter-industry wage differentials could only be accounted for by competitive theory if they reflected either non-pecuniary job attributes and / or unobserved labour quality. In either case the equalisation of net advantage still holds. Workers do not earn rents.

The former of these two suggestions is addressed by the inclusion of additional controls for non-pecuniary benefits. The results of Krueger and Summers (1988) indicate that, if anything, the importance of industry affiliation rises.

The issue of unobserved labour quality is more problematic. Krueger and Summers (1988) attempt to address the problem in the manner noted above, by estimating a wage equation in first-differences on the assumption that unobserved ability is a fixed effect. To do so however requires that unmeasured ability is constant over time and equally valued by different industries. Nevertheless, the results indicate that estimation in first-differences does not significantly alter the importance to be assigned to industry affiliation.

In order to further address the issue of whether inter-industry differentials may reflect competitive returns to unobserved ability Krueger and Summers (1988) also consider the relation between wage premia and rates of turnover. This follows the approach of Pencavel (1970) and the suggestion that if such wage differentials reflect competitive returns then they should not be significantly related to quit rates. Workers in both high and low paying industries would be receiving no more than their opportunity cost of labour. The results of Krueger and Summers (1988) indicate an insignificant negative relation between industry wage premia and quit rates and significant positive relation with job tenure.

More recently Holzer *et al.*, (1991) consider the relation between application rates and inter-industry wage differentials in low wage labour markets. Again. the intuition is that if such wage differentials reflect the presence of (ex ante) rents then high wage industries should attract a greater number of applicants. Whilst some evidence exists for such a relation, it is not wholly robust to the inclusion of controls for employer size and union presence.

That inter-industry differentials are merely picking up unmeasured ability is considered by Murphy and Topel (1987). Murphy and Topel (1987) obtain cross-sectional estimates of θ using March CPS data for 1977-84. Strictly, however, Murphy and Topel (1987) classify jobs according to industry and occupational status, rather than controlling for occupation separately. In a wage growth equation, the change in the estimated industry / occupation effect is then included alongside the vector of observables, X .

$$\Delta \ln w_{it} \quad = \quad \alpha + \Delta X_{it}{}' \beta + \delta \, \Delta \hat{\theta}_{it} + \Delta u_{it} \qquad (3)$$

The existence of true industry effects in the cross-sectional earnings equations implies $\delta = 1$, whilst an unobserved ability explanation suggests $\delta = 0$. The estimate obtained by Murphy and Topel (1987) when instrumenting for $\Delta\hat{\theta}$ is 0.29 i.e. on average, individuals who move between industry-occupation classifications receive 29 % of the wage gain predicted by cross-sectional estimates of industry effects.

Two points stand out as potential explanations of the difference in results and moreover, why the Murphy and Topel (1987) results may be misleading. First, the classification of status on the basis of an amalgam of industry and occupation status is likely to bias downward the estimate of δ since occupational mobility is much more likely to be determined by unobserved ability. Second, the wage measure employed refers to aggregate earnings for the year as a whole and will confuse that earned in the two different industries for those who switched industry. This leads Gibbons and

Katz (1992) to suggest that the estimate of the change in the individual's industry differential associated in Equation 3 will be downward biased[3] .

Gibbons and Katz (1992) address more directly the issue of unmeasured ability in inter-industry differentials. They consider the issue of whether ability is not equally valued by different industries and hence where learning occurs with regard to unmeasured ability, mobility is not exogenous. The individuals that switch industry are not a randomly-selected subsample of workers. Such circumstances would imply that unmeasured ability cannot be taken to be a fixed effect and hence the estimation results of Krueger and Summers (1988) would be inconsistent. Empirically, the issue is addressed by using the 1984 and 1986 Displaced Workers Surveys (DWS). It is maintained that using data solely on those displaced for reasons of plant closing, slack work or position that was eliminated, corresponds closely to the notion of exogenous job loss and hence exogenous switching between industries. Results indicate that the estimated importance of inter-industry wage differentials remains similar to that obtained on the basis of cross-section earnings equations. The standard deviations of the estimated industry wage differentials on the basis of cross-section and first-differenced for the DWS data are 0.13 and 0.12 respectively.

Gibbons and Katz (1992) also consider the endogeneity issue regarding *to which* industry it is that an individual moves. This is done by regressing the individual's *post-displacement* earnings on the vector of *pre-displacement* individual characteristics and *pre-displacement* industry.

$$\ln w_{it} = \alpha + X_{it-1}{}'\beta + \sum \gamma_j D_{ijt-1} + u_{it} \qquad (4)$$

In this way, it is the impact of pre-displacement industry upon post-displacement earnings which is being considered. The unmeasured ability model would argue that for given pre-displacement worker characteristics, those (exogenously) displaced from high wage industries should have higher post-displacement earnings than those displaced from low-wage industries. Results indicate support for this suggestion in

3 Murphy and Topel (1987) suggest a correction which leads to a revised estimate of δ of 0.365 for the IV result. This correction rests on assumptions regarding the distribution of transitions during the year.

that those displaced from high wage industries maintain a significant differential over those displaced from a low wage industry. Gibbons and Katz (1992) find that the importance of *pre-displacement* industry upon *post-displacement* earnings is between 42 and 47 % as important as the effect of *pre-displacement* industry on *pre-displacement* earnings. However, a positive effect is not inconsistent with a 'true-industry effects' explanation. Gibbons and Katz (1992) estimate that according to such a model the relation between the two estimated sets of coefficients would be 31%. Again the conclusion must be that whilst an endogeneity issue is present it can only account for a fraction of the estimated inter-industry wage variation which remains quantitatively large.

Of further interest in terms of the literature on industry wage differentials is the characteristics of high-paying industries, not least because this may offer further insight into the source of their existence. Whilst this point has been noted above in terms of the relation between wage premia and turnover or application rates, a number of further industry characteristics have been considered by Dickens and Katz (1987)[4] .

Included among these characteristics are industry profitability, product market power (proxied by concentration) and capital-labour ratios which, although not entirely robust across the different papers reviewed, do strongly suggest a positive association with wages. However, even if this does indicate the earning of non-competitive rents it does little to discriminate between efficiency wage theory and bargaining models.

Thus the estimation of inter-industry wage differentials has developed into an established aspect of the study of labour markets. However, the state of knowledge for Great Britain in this area lags that of other nations, most notably that of the United States[5]. The sole UK study of inter-industry wage differentials using individual level U.K. data is that of Hildreth (1995) presenting cross-sectional and longitudinal evidence based upon the 1991 and 1992 waves of the BHPS. Employing the 1991 and 1992 BHPS as pooled cross-sections and using a full set of human capital controls, results in a weighted adjusted standard deviation of one-digit industry

4 Katz and Summers (1989) carry out a similar analysis.

5 Evidence for further countries includes that for Canada (Gera and Grenier, 1994), Finland (Vainiomaki and Laaksonen, 1995) and Sweden (Edin and Zetterberg, 1992; Arai, 1994.)

differentials of 0.086. Hildreth (1995) considers a range of potential explanations, some of which are non-competitive. However, Hildreth (1995) is unable to consider the principal non-competitive rationale for such differentials - that they are related to inter-sectoral differences in ability-to-pay. This hypothesis may only be convincingly addressed through access to profitability data which the BHPS does not contain. To this end, the present study merges industry profitability measures to our study of waves 1 and 4 of the BHPS in order to consider this issue. Hildreth (1995) also finds that much of the cross-sectional variation in wages attributed to industry affiliation is removed by estimation in first-differences. This is interpreted as suggesting that industry wage differentials in Great Britain are, to a significant degree, to be explained in terms of unobserved ability differences. One weakness of the analysis is that in first differences, it relies upon a relatively small number of individuals switching sector. Thus a case can be made for arguing that it is hardly surprising that the differential associated with the highest-paying sector in the cross-sectional analysis, Energy and Water Supply, disappears in the fixed effects analysis when the latter relies upon only 5 individuals moving into that sector, with 6 leaving that sector between waves 1 and 2 of the survey. Thus our analysis in employing waves 1 and 4 of the BHPS benefits from enjoying a greater number of individuals switching between sectors and relatedly allows a slightly lower level of aggregation in the industry variables. The number of individuals switching between sectors is over 70 % higher than that present in Hildreth's (1995) study.

4 Estimation and Results

The Data

The data employed in our analysis is derived from the British Household Panel Survey (BHPS). The BHPS represents a household- and individual-level, nationally representative survey. The dataset consists of more than 5000 households and 10000 individuals at the first wave, conducted between September 1991 and April 1992. The fourth wave data was collected during the period September 1994 to April 1995. The dataset is sufficiently rich in terms of available information on each individual to allow the estimation of standard earnings equations for both cross-sectional and longitudinal analysis.

Cross-sectional Analysis

We include a standard set of human capital and demographic explanatory variables in our earnings equations. Dummy variables indicating the highest academic qualification obtained are included alongside a quadratic in experience and dummy variables for employer size, union presence - membership and coverage at place of work - part-time status, race and gender. Additional controls for tenure (in current position), health status and managerial status are also included. The specifications also include dummies for occupation and region alongside the industry dummies which are designed to pick up the importance of industry effects. The dependent variable consists of the (natural) log of hourly earnings. This is derived from a point-in-time measure of earnings for the month (generally preferred over annual measures) and hours worked per week[6] . We prefer to work with an hourly rather than weekly measure of earnings since hours worked per week will tend to vary systematically between industries. Estimates of inter-industry wage differentials obtained on the basis of weekly earnings would therefore meet with the objection that they are in fact picking up an hours effect. The sample is restricted to private sector employees aged

6 see Data Appendix for further details regarding variable definitions and data description.

between 16 and 65. The first-differenced sample must satisfy this selection rule in both years.

The level of aggregation involved in the construction of the industry dummy variables was essentially determined by the need to possess a sufficiently healthy number of observations per industry and, in particular a sufficient number of 'switchers' between industries for the purposes of our first-differenced estimates. Although this issue is not entirely avoided to our satisfaction in the case of certain sectors, the level of aggregation is slightly higher than the "1.5 - digit" industries employed by Gibbons and Katz (1992). Our concern in describing the importance of relative wage structure by industry, rests on the variation in earnings resulting from industry affiliation. Alongside the implied differentials by industry and by movement from the lowest- to the highest paying industry, we also present a summary statistic representing the standard deviation of the industry effects.

We begin by presenting our cross-sectional estimation results, referring to the 1991 and 1994 waves of the BHPS, in Table 1.

The anticipated positive returns to human capital in the form of educational qualifications and years of (potential) experience are evident, with the latter effect declining over an employee's working life as implied by a (linearly) declining proportion of time being invested in on-the-job training. The estimates in column 1 indicate that earnings reach a maximum after 27.6 years of experience. Evidence for the positive employer-size wage effect is also found. The estimate of the union wage differential is similar to the base model employed by Andrews *et al,* (1996) using the 1991 BHPS, employing a different specification and sample selection criteria. The total union wage differential is 10.5 % and significant with the coverage differential being estimated at 2.6% and insignificant, the differential attributable to membership being almost 8 %[7] .

The importance of industry affiliation in determining relative wages is reflected in the reported standard deviation of industry coefficients. The standard

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7 The union variables in the 1994 wave are coded on the assumption that individuals who did not change job from the previous wave did not either change union status (and similarly for waves 2 and 3), since the relevant union questions were only asked of those reporting a job change since the previous wave. Clearly, some misclassification of union status will result.

deviation is adjusted to correct for the least squares sampling error[8] . The coefficients report differentials relative to the omitted group of Business Services. These differentials may also be adjusted in order to represent the differential between an employee in the particular industry and the average employee. In so doing, we estimate that individuals employed in Hotels and Catering (the lowest-paying sector) earn 18 % below the mean after controlling for their relevant individual and job characteristics, with those employed in Banking and Finance (the highest-paying sector) enjoying a 22 % pay premium relative to the average.

The results reported in Table 1 suggest that industry affiliation is an important determinant of wages. The weighted, adjusted standard deviation of industry effects, at 0.121 is slightly greater than that reported by Hildreth (1995), largely due to the fact that we do not select out part-time workers from our sample. Since these tend to be located in the low-paying sectors, our weighted standard deviation of the industry coefficients attaches a greater weight to such low-paying sectors. This is especially true when we consider variation in industry wage premia between men and women (see Table 2). Taking a one standard deviation movement across industries to reflect a 'typical' change in industry, suggests that industry attachment exerts an influence upon wages which is at least as large as that associated with a change of union status or employer size. The correlation between the estimated differentials for 1991 and those for 1994 is 0.95. The Spearman correlation coefficient between the 1991 and 1994 industry wage differentials is equal to 0.82 (p-value = 0.00)

Table 2 confirms that these results are rather robust across a range of employee and employer characteristics. As in Hildreth (1995), we find that there is evidence for some difference in the pattern of these differentials between men and women.

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8 Following Krueger and Summers (1988) : $SD_{adj} \approx \sqrt{\operatorname{var}(\theta) - \sum_{i=1}^{K} (w_i\sigma_i)^2 / K}$.

Var (θ) represents the (weighted) variance of the estimated industry coefficients, K denotes the number of industries, w_i the weight attached to industry 'i' with the sum of the weights given by the number of industries and σ_i represents the estimated standard error of the industry 'i' regression coefficient. The expression is an approximation since it ignores covariance terms, although these are likely to be of only very minor quantitative importance (but would lead to an upward correction to SD_{adj}).

A hypothesis regarding the nature of such inter-industry differentials which would be consistent with competitive theory, and has been neglected in the literature with the exception of a comment by Keane (1993), would be if wages varied by industry due to differences in age-earnings profiles. Thus individuals (in particular relatively young workers) may be willing to work in a low-paying industry if it offers a steeper age-wage profile. Note that this is a potentially important point since it also suggests the presence of industry effects in longitudinal as well as cross-sectional analysis. In order to address this point we re-estimate the cross-sectional earnings equation separately for each industry and use the coefficients on the years of potential experience terms as a basis for inferences regarding the shape of age-earnings profiles by industry. The resulting plots of the log hourly earnings profile in years of experience are provided in Figures 1 A - N. The steepest profiles are found in the Extraction of Minerals and Construction industries, neither of which are low paying industries. The lowest-paying industry, Hotels and Catering, which alongside Food, Drink and Tobacco and Other Services (another low-paying industry) has the least steep profile. These results are not therefore consistent with a competitive story which explains inter-industry wage differentials on the basis of compensation for differences in anticipated rewards to experience.

In an attempt to obtain some further insight into the characteristics of the high versus low-paying industries, these cross-sectional estimated differentials were correlated against a set of industry characteristics, constructed from company accounts data (see Data Appendix A.3).

As anticipated, there appears to be a positive relation between the industry wage premium and industry profitability. Figure 2 offers a plot of our estimated industry wage premia against measures of profitability. The overall pattern of results, alongside the robust regression lines, are suggestive of a positive relation between industry wage differentials and profitability[9] . At least in cross-section, these differentials appear to be positively related to measures of industry ability to pay.

In Figure 3 we consider the relation between these industry differentials and a number of further industry characteristics. There is evidence of a positive relationship

9 The Banking and Finance profit margin is an outlier in Figure 2 at least partly because companies in this ector have a tendency to report low values of 'sales' in their company accounts.

between the estimated differentials and the industry capital-labour ratio and industry concentration. The former result is consistent with one implication of the theoretical model of Montgomery (1991). No evidence is found in favour of Slichter's (1950) suggestion that such wage premia are inversely related to the magnitude of labour costs relative to sales revenue. These hypotheses are not considered by Hildreth (1995).

Of further interest is the relationship between these estimates of industry wage premia and levels of job satisfaction, in particular regarding levels of pay. Thus if such differentials are indicative of supernormal rewards, this would suggest a positive relationship between industry differentials and the average level of satisfaction regarding pay within the industry. It is difficult on the basis of Figure 4 to make a strong claim for a relationship in either direction.

Longitudinal Analysis

We now turn to the important question of whether such inter-industry wage differentials are maintained in the context of first-differenced estimates of our earnings equations. Note that there are very few individual-level longitudinal wage equations for Great Britain against which these results in general might be compared.

As anticipated, the importance of industry affiliation declines somewhat according to the first differenced estimates, which are able to more fully control for unobserved ability. The weighted-adjusted standard deviation is 0.049. This mirrors the principal result of Hildreth (1995). One source of concern in these fixed effects estimates lies in the limited number of industry switchers on which they rely (see Data Appendix). Relatively few switchers is likely to give rise to poorly-determined coefficients and lower values for the summary statistics representing the importance of industry affiliation. Nevertheless, the fixed effects results continue to indicate that industry attachment is of importance in determining the wage structure. Thus the point estimates suggest that a change from the lowest-paying sector, Hotels and Catering, to the highest-paying sector, Metal Goods and Engineering, implies a wage change of 22 %. Quantitatively, this is not an insignificant amount.

In Figure 5 we plot the estimated cross-section coefficients against their panel data counterparts. It is clear that there is a reassuringly positive relation between the two sets of estimates. The large positive pay premium associated with employment in the Banking and Finance sector, in cross-section, disappears in the fixed effects analysis. This might suggest that unobserved ability is a more important factor in this sector of the economy. If it is the case that this sector devotes considerable resources to screening of candidates at the recruitment stage and also recruits some of the most highly educated individuals of a particular young cohort, this might suggest that it recruits individuals of higher ability that is unobserved to the econometrician and for which in a cross-sectional analysis, it is not possible to control.

Clearly of some interest is whether the estimated wage differentials on the basis of the longitudinal analysis are also positively related to industry profitability in the same manner as those estimates obtained on the basis of the cross-sectional estimation. Figure 6 provides the plot of differenced estimates of the industry effects and measures of profitability. There is some evidence of a positive relation between the difference estimates of the industry premia and profit-per-worker. A priori, profit-per-worker should be our preferred measure of profitability since it emerges as the relevant ability-to-pay variable in bargaining models (e.g. Oswald, 1995). However, statistically, the relation is not especially well-determined, with a 't-ratio' on the basis of the robust regression estimates of 1.4.

Mindful of the potential problems associated with estimation of wage gaps using panel data, in Table 5 we test for potential asymmetries between the effects of industry experienced by those joining to those leaving a particular industry. Our results indicate that our main conclusions are robust to this consideration. The implied restrictions present in the previous results are individually and jointly accepted with some margin. The relatively small numbers of individuals we have switching between some industries renders some of the individual coefficients less well-determined and this is reflected in Figure 7 which, whilst illustrating a clear inverse relation between the wage effects experienced between those leaving and joining a particular industry, shows that this is also subject to some noise. The coefficient (standard error) on the fitted robust regression line is -0.705 (0.345). The implied restriction on the Textiles industry comes close to being rejected however, at the 5 % level, indicating that a consideration of asymmetric effects is a worthwhile issue to examine in general when estimating wage gaps on the basis of panel data.

5 Concluding Remarks

The Chapter has considered the determination of earnings of private sector employees using individual-level data from the British Household Panel Survey. Significant variation in relative wages according to industry status was found after controlling for a range of human capital and demographic characteristics in the cross-sectional analysis. The employment-weighted standard deviation of industry coefficients for both 1991 and 1994 was found to be approximately 12 %. The estimated differentials were not sensitive to a number of alternative sample definitions and hence do not appear to be confined to individuals with particular characteristics.

Further, we were able to consider the relation between these estimated differentials and a number of industry characteristics. The results from the cross-sectional analysis tended to suggest that competitive theory was unlikely to provide a convincing explanation for such differentials. Results failed to suggest an inverse relation between industry wage premia and the steepness of age-earnings profiles. In addition evidence for a positive relation between the estimated differentials and industry profitability and concentration was also found in our cross-sectional analysis. There was however, a poorly defined relation between the premia and the average level of satisfaction with pay reported by individuals in a particular industry.

Estimated cross-sectional relationships can moreover, encounter some difficulty in establishing causality, particularly where there is a strong a priori reason to anticipate that there may be omitted and exogenous variables correlated with both the dependent variable and explanatory variable(s) in question. To control for such omitted unobservables is a prime advantage of the use of panel data. First-differenced estimates indicated a significant decline in the importance to be attached to industry affiliation, the standard deviation falling to 4.9 %. Thus, for Great Britain much of the estimated cross-sectional estimated industry differentials appear to be removed by the introduction of fixed effects. However, it was also argued that when first-differenced estimates rely on small numbers of individuals switching between sectors, which tends to give rise to poorly determined coefficients, then a more informative measure of the influence of industry affiliation may be provided by the range of wages implied by moving from the lowest- to the highest-paying industry. This range of wages emerges as 22 %. One is no longer left with the impression that industry status is of little importance in the determination of wages. This issue has not arisen in the studies of inter-industry wage differentials for the United States which have benefited from employing larger datasets with correspondingly larger numbers of individuals switching between sectors. The results may indicate that employing the New Earnings Survey panel may provide an interesting future direction for research into the existence and magnitude of inter-industry wage differentials in Great Britain.

In our fixed effects analysis, the suggestion of a positive relation between the estimated wage premia and industry profit-per-worker also emerged. This was, however, less well defined than the estimated relationship based on the cross-sectional wage premia estimates. This might be consistent with the argument that partly responsible for the cross-sectional positive relation between wage premia and profitability was that such profitable sectors were recruiting individuals of greater unobserved ability. Hence the first-differenced estimates which are more successful in controlling for unmeasured human capital encounter more difficulty in detecting a similar positive relation.

This line of research might also be viewed as complementary to other micro-based studies of wage determination, concerned with the forces of wage determination and whether these might accurately be reflected in market-clearing theories (e.g. Nickell and Wadhwani, 1990 and see Oswald, 1995, for a review). Such studies have tended to be operationalised in the context of a bargaining framework with a prime concern being in the form of examining the relation between firm-level wages and ability-to-pay. It should be clear however, that the weaker relation between estimated industry wage differentials and profitability in the first-differenced analysis controlling for fixed effects, does not necessarily imply a questioning of a rent-sharing approach to wage determination. Thus we know that profits largely accrue at the firm- not an industry-level, such that industry-level profitability is likely to be a poor indicator of financial performance for the level at which wages are determined by bargaining.

Table 1: Cross-sectional Wage Equations and Industry Affiliation
Dependent Variable : log hourly wage ; (standard errors)

highest qualification obtained :	1991	1994
Apprenticeship	0.129 (0.051)	0080 (0.070)
CSE Grades 2-5	0.061 (0.034)	0.042 (0.044)
Commercial Qualifications	0.041 (0.042)	0.140 (0.052)
GCE O-level	0.109 (0.022)	0.116 (0.027)
GCE A-level	0.164 (0.027)	0189 (0.033)
Nursing	0.202 (0.082)	0.146 (0.082)
Other Higher Qualification	0.246 (0.027)	0.252 (0.031)
Teaching	0.123 (0.119)	0.086 (0.093)
First Degree / Higher Degree	0.447 (0.037)	0.401 (0.042)
experience	0.029 (0.002)	0.026 (0.003)
*experience-squared	-0.052 (0.005)	-0.050 (0.006)
size : 25 to 99 employees	0.126 (0.019)	0.089 (0.022)
size : 100 to 499 employees	0.131 (0.020)	0.167 (0.023)
size : 500 or more	0.210 (0.025)	0.231 (0.030)
union member X coverage	0.100 (0.020)	0.104 (0.025)
(1-union member) X coverage	0.026 (0.022)	0.005 (0.025)
male	0.207 (0.018)	0.178 (0.021)
white	0.012 (0.038)	-0.014 (0.048)
married	0..095 (0.018)	0.105 (0.021)
part-time	0.002 (0.022)	0.004 (0.026)
managerial duties	0.127 (0.018)	0.143 (0.022)
*tenure	0.075 (0.025)	0.120 (0.031)
**tenure-squared	-0.018 (0.007)	-0.027 (0.010)
poor health	-0.033 (0.035)	-0.045 (0.043)
occupation dummies	yes (8)	yes (8)
region dummies	yes (10)	yes (10)
Industry Affiliation :		
Energy	0.006 (0.042)	-0.044 (0.052)
Extraction of Minerals	-0.005 (0.044)	-0.004 (0.050)
Metal Goods & Engineering	-0.056 (0.038)	-0.042 (0.048)
Elec. Enginrg & Motor Vehicles	-0.036 (0.035)	-0.046 (0.041)
Food, Drink & Tobacco	-0.091 (0.043)	-0.151 (0.050)
Textiles, Footwear & Furniture.	-0.080 (0.033)	-0.068 (0.040)
Construction	-0.098 (0.044)	-0.036 (0.054)
Wholesale Distribution	-0.104 (0.041)	-0.076 (0.046)
Retail Distribution	-0.211 (0.033)	-0.210 (0.039)
Hotels & Catering	-0.251 (0.040)	-0.273 (0.045)
Transport & Communication	-0.092 (0.038)	-0.093 (0.044)
Banking & Finance	0.133 (0.037)	0.114 (0.042)
Business Services	-	-
Other Services	-0.175 (0.038)	-0.155 (0.043)
constant	0.538 (0.062)	0.780 (0.083)
weighted adj. st. dev. of industry effects	0.121	0.112
F-test industry dummies	F(13, 2846) = 10.51 [p=0.00]	F(13, 2643) = 7.50 [p=0.00]
F-test occupation dummies	F(8, 2846) = 21.61 [p=0.00]	F(8, 2643) = 10.51 [p=0.00]
F-test region dummies	F(10, 2846) = 20.18 [p=0.00]	F(10, 2846) = 10.51 [p=0.00]
Root M.S.E.	0.372	0.427
Mean of dependent variable	1.500	1.597
R-squared	0.552	0.498
R-bar squared	0.543	0.488
sample size	2902	2699

Notes to Table 1:

1. sample refers to private sector employees aged between 16 and 65.
2. dependent variable is the log of usual hourly wage-rate.
3. * denotes coefficient and standard error have been multiplied by 100 ;
   ** denotes coefficient and standard error have been multiplied by 10^4.

Table 2 : Alternative Samples and Estimated Industry Wage Differentials, 1991			
Sample Definition	weighted & adjusted st. dev of industry effects	Spearman correlation betw. defn. and alternative	sample size
Union Sector			
covered	0.154	0.621	1126
not covered	0.134	[p=0.02]	1776
Age			
20 to 35	0.099	0.670	1322
40 to 65	0.091	[p=0.01]	1057
Gender			
male	0.085	0.451	1611
female	0.175	[p=0.12]	1291
Job Tenure			
up to 2 years	0.128	0.824	1266
greater than 2 years	0.107	[p=0.00]	1636
Managerial Duties			
yes	0.138	0.873	962
no	0.106	[p=0.00]	1940
Workplace Size			
less than 50 employees	0.147	0.577	1443
50 or more employees	0.100	[p=0.04]	1459

Notes :

1. For explanatory variables included see Table 1.

Table 3 : First Differenced Estimates of Wages and Industry Affiliation
(standard errors)

*experience^2	-0.077 (0.013)
size : 25 to 99 employees	0.046 (0.025)
size : 100 to 499 employees	0.071 (0.029)
size : 500 or more employees.	0.075 (0.037)
union member X coverage	0.116 (0.043)
(1-union member) X coverage	0.043 (0.041)
married	0.080 (0.030)
part-time	0.151 (0.038)
managerial duties	0.048 (0.022)
*tenure	0.035 (0.034)
**tenure-squared	-0.004 (0.010)
poor health	0.023 (0.039)
occupation dummies	yes (8)
region dummies	yes (10)
Industry Affiliation :	
Energy	0.114 (0.090)
Extraction of Minerals	0.180 (0.070)
Metal Goods & Engineering	0.109 (0.061)
Elec. Engineering & Motor Vehicles	0.111 (0.056)
Food, Drink & Tobacco	0.072 (0.071)
Textiles, Footwear & Furniture.	0.171 (0.058)
Construction	0.061 (0.089)
Wholesale Distribution	0.115 (0.055)
Retail Distribution	0.001 (0.053)
Hotels & Catering	-0.024 (0.062)
Transport & Communication	-0.002 (0.070)
Banking & Finance	0.053 (0.060)
Business Services	-
Other Services	0.043 (0.058)
constant	0.228 (0.017)
weighted adjusted. st. dev. of industry effects	0.049
F-test industry dummies	F(13, 1484) = 1.78 [p=0.04]
F-test occupation dummies	F(8, 1484) = 2.70 [p=0.01]
F-test region dummies	F(10, 1484) = 3.13 [p=0.00]
Root M.S.E.	0.367
R-squared	0.110
R-bar squared	0.084
sample size	1528

Table 4: Wages and Industry Affiliation
First Differenced Estimates with Separate Effects by Entry and Exit
(standard errors)

	By Entry	By Exit	Test of Symmetry F (1, 1471)
Energy	0.141 (0.128)	-0.073 (0.118)	0.16 [p=0.69]
Extraction of Minerals	0.259 (0.087)	-0.081 (0.097)	2.27 [p=0.13]
Metal Goods & Engineering	0.140 (0.091)	-0.080 (0.074)	0.33 [p=0.56]
Elec. Enginrg & Motor Vehicles	0.151 (0.075)	-0.117 (0.071)	0.14 [p=0.71]
Food, Drink & Tobacco	0.083 (0.091)	-0.071 (0.097)	0.01 [p=0.92]
Textiles, Footwear & Furniture.	0.084 (0.076)	-0.237 (0.070)	3.07 [p=0.08]
Construction	0.035 (0.112)	-0.080 (0.137)	0.07 [p=0.80]
Wholesale Distribution	0.144 (0.067)	-0.084 (0.075)	0.49 [p=0.49]
Retail Distribution	0.009 (0.077)	-0.002 (0.060)	0.00 [p=0.93]
Hotels & Catering	-0.016 (0.075)	0.035 (0.084)	0.04 [p=0.84]
Transport & Communication	0.039 (0.084)	0.093 (0.109)	1.06 [p=0.30]
Banking & Finance	0.034 (0.084)	-0.064 (0.083)	0.07 [p=0.80]
Business Services	-	-	-
Other Services	0.091 (0.075)	0.002 (0.076)	0.93 [p=0.33]
Joint Test of Equal and Opposite Coefficients	F (13, 1471)	0.62 [p=0.84]	
Root M.S.E.		0.368	
R-squared		0.115	
R-bar squared		0.081	
sample size		1528	

Notes :

see Table 3 for additional explanatory variables.

Data Appendix

Table A1 : Data Definition and Data Description.

Sample means and standard deviations referring to the dataset employed in the 1991 cross-section (n=2902).

Variable	Description	Mean (s.d.)
Educational Qualifications	Highest Educational Qualification obtained :	
Apprenticeship	1 if Apprenticeship	0.021
CSE Grades 2-5	1 if CSE Grades 2-5	0.061
Commercial Qualifications	1 if Commercial / Clerical Qualifications	0.034
GCE O-level	1 if GCE O-level or equivalent	0.284
GCE A-level	1 if GCE A-level	0.134
Nursing	1 if Nursing Qualification	0.009
Other Higher Qualification	1 if Other Higher Qualification	0.147
Teaching	! if Teaching Qualification	0.004
First Degree / Higher Degree	1 if First Degree or Higher Degree	0.069
Experience	Imputed Potential years of experience; imputed on the basis of expected age at which obtained highest educational qualification.	17.835 (12.635)
Size : 25 - 99 employees	1 if place of work has 25-99 employees	0.242
Size : 100 - 499 employees	1 if place of work has 100-499 employees	0.251
Size : 500 or more	1 if place of work has 500 or more employees	0.142
union member X coverage	1 if member of union and union is recognised.	0.252
(1-union member) X coverage	1 if not-union member and union is recognised at place of work.	0.133
male	1 if male	0.577
white	1 if white	0.961
married	1 if married or living as a couple	0.674
part-time	1 if works part-time (individual's response)	0.185
log hourly wage	log of usual hourly wage or salary before tax and other deductions. This is calculated from usual monthly pre-tax salary (E) and data on hours worked as follows : $w = \dfrac{E}{4.33*(h_b + h_{uo} + 1.5h_{po})}$ where h_b denotes basic hours per week, h_{uo} unpaid overtime and h_{po} paid overtime hours, such that we assume a 50% pay premium for (paid) overtime hours. The assumption of a constant premium in overtime hours finds support in Hart and Ruffell (1993). Imputed values on E are rejected.	1.500 (0.551)
managerial duties	1 if manager or supervisor / foreman	0.329
poor health	1 if reports poor or very poor health over previous yr	0.042
tenure	tenure in current position (months)	53.162 (69.954)

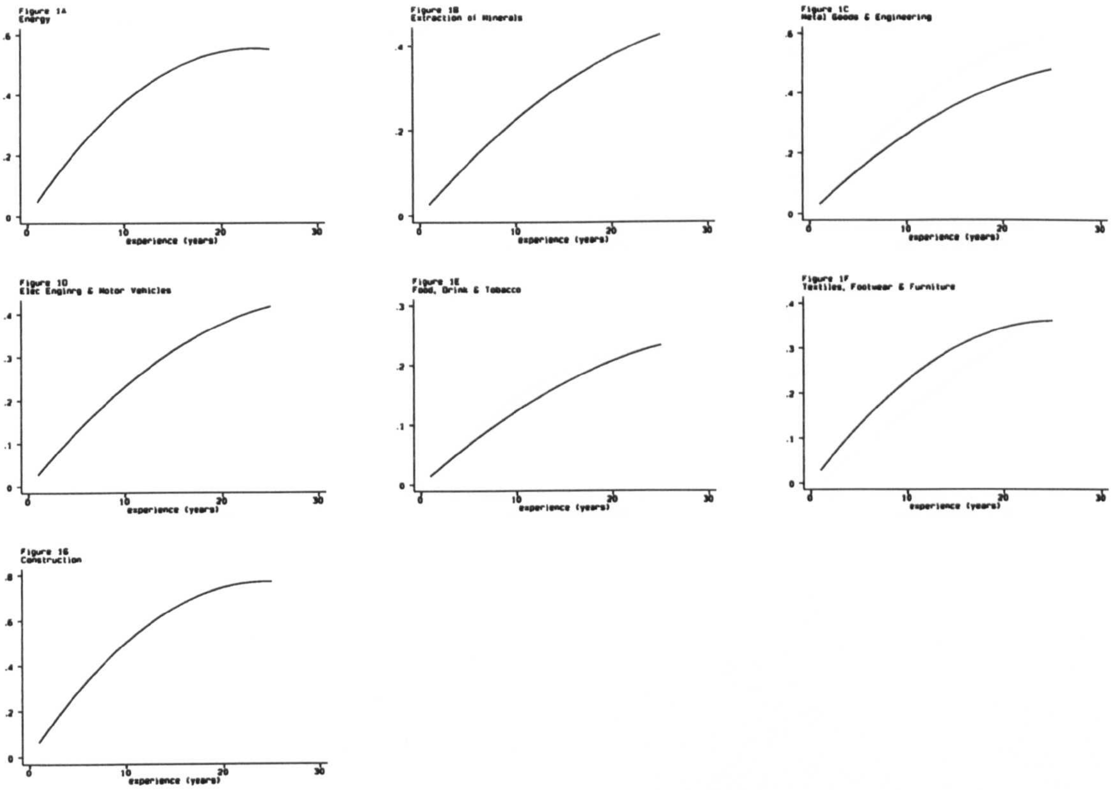
Table A2. Distributions of Sample by Industry

Industry	Proportion in Sample 1991 Cross-section	Numbers of Movers & Stayers 1991-94 [n=1612]		
		movein	stay in / out	move out
Energy	0.052	12	1505	11
Extraction of Minerals	0.049	20	1485	23
Metal Goods & Engineering	0.076	46	1458	24
Elec. Enginrg & Motor Vehicles	0.107	43	1440	45
Food, Drink & Tobacco	0.045	21	1485	22
Textiles, Footwear & Furniture.	0.125	42	1445	41
Construction	0.047	8	1507	13
Wholesale Distribution	0.052	32	1447	49
Retail Distribution	0.099	75	1416	37
Hotels & Catering	0.050	30	1457	41
Transport & Communication	0.067	15	1490	23
Banking & Finance	0.075	23	1482	23
Business Services	0.101	39	1429	60
Other Services	0.057	40	1454	34

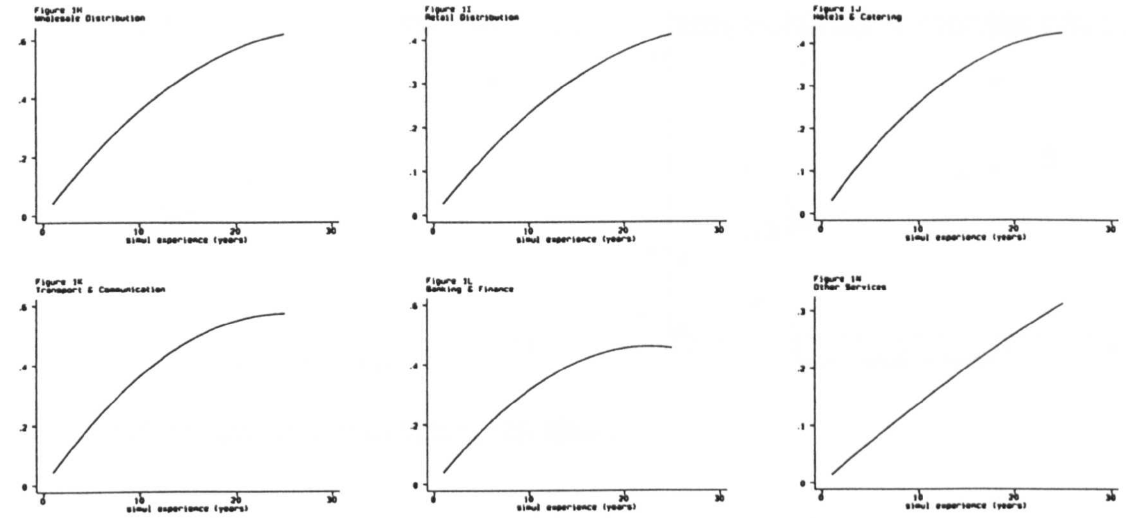
Table A.3 Industry Characteristics

The additional variables representing measures of certain industry characteristics were constructed from company-level data on the population of companies available from the Datastream International database for 1991, the number of companies being 1035. Each company is allotted a datastream industry code. These were then matched to the corresponding two-digit SIC code since it is on this SIC basis that our industry dummy variables are constructed.

Industry Variable	Construction	Mean (s.d.)
Return on Assets	The ratio of industry profits (summing Datastream Item 137 across the SIC-based industry groups) to total capital stock where the latter is given by the sum of gross historic cost of plant and machinery (Item 328) and buildings (Item 327) also summed across firms in the industry.	0.2206 (0.1010)
Profit Margin	The ratio of industry profits (summing Item 137 on Datastream across the SIC-based industry groups) to total sales revenue (Item 104).	0.0969 (0.0852)
Profit Per Worker	The ratio of industry profits (summing Item 137 on Datastream across the SIC-based industry groups) to total number of employees (Item 219). Units : £ 000.	6.289 (4.308)
Concentration	A herfindahl index was constructed for each firm's datastream industry. The corresponding concentration for each of our industry classifications referred to in the text was then obtained by attaching equal weight to the associated two-digit SICs.	0.2854 (0.1875)
Capital-Labour Ratio	To obtain the measure of capital stock we sum Item 328 (gross historic cost of plant and machinery) and Item 327 (gross historic cost of buildings) across the SIC-based industry groups. The measure of labour is derived from Item 219, total number of employees.	30.0825 (14.2624)
Labour Costs-Sales Ratio	The ratio of industry labour costs (summing Item 215 on Datastream across the SIC-based industry groups) to total sales (Item 104).	0.167 (0.056)



Age-Earnings Profiles By Industry



Age-Earnings Profiles By Industry

STATA™

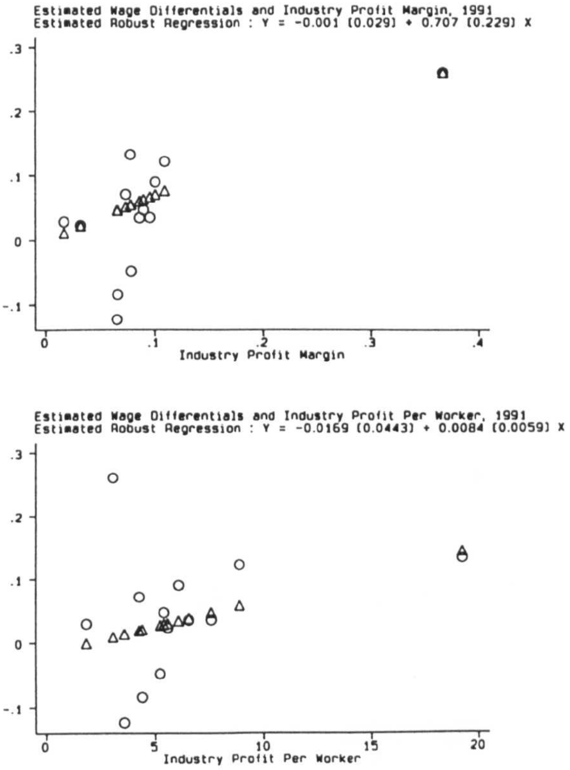


Fig 2 : Industry Premia and Profitability

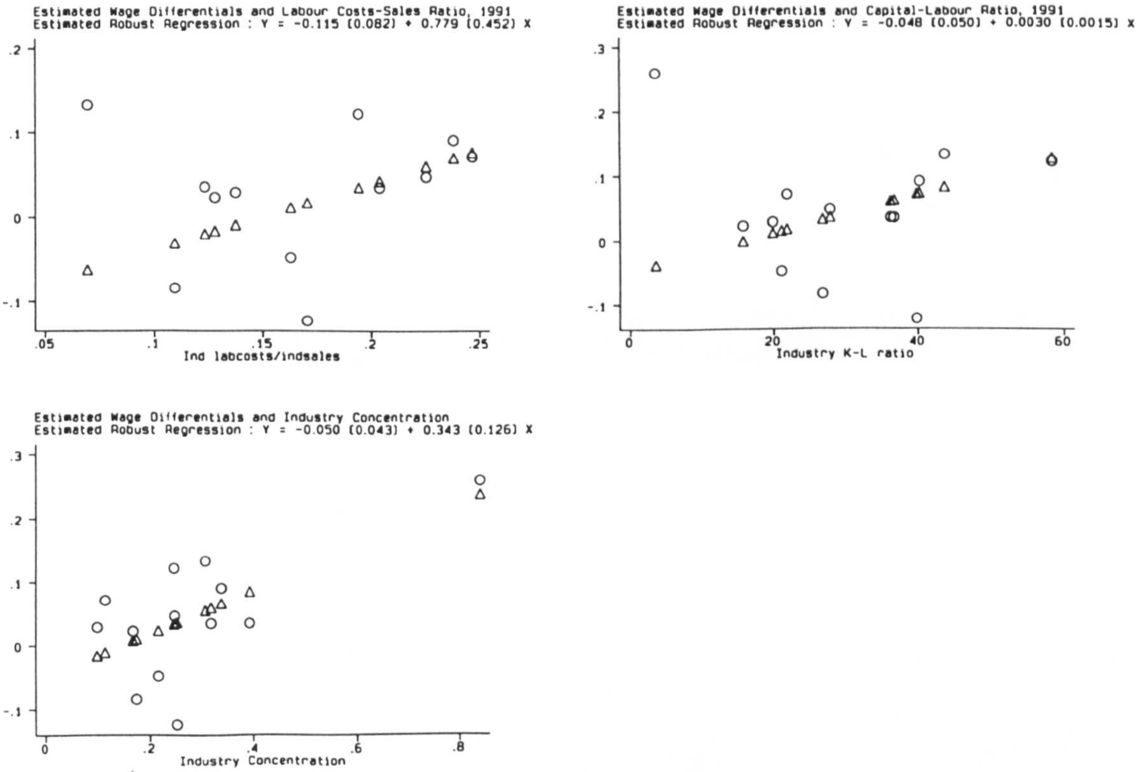
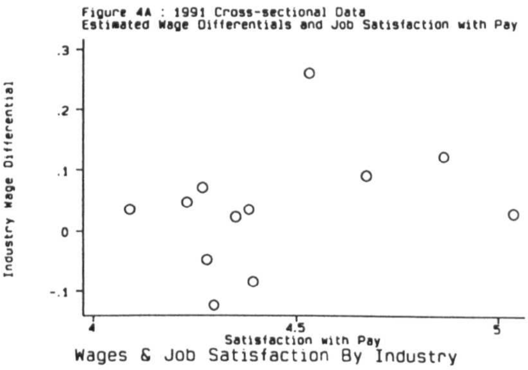

Estimated Wage Differentials and Labour Costs-Sales Ratio, 1991
Estimated Robust Regression : Y = -0.115 [0.082] + 0.779 [0.452] X
Ind labcosts/indsales
Estimated Wage Differentials and Capital-Labour Ratio, 1991
Estimated Robust Regression : Y = -0.048 [0.050] + 0.0030 [0.0015] X
Industry K-L ratio
Estimated Wage Differentials and Industry Concentration
Estimated Robust Regression : Y = -0.050 [0.043] + 0.343 [0.126] X
Industry Concentration

Figure 3



Wages & Job Satisfaction By Industry

Wages & Job Satisfaction By Industry

Fig 4 : Industry Premia and Job Satisfaction

STATA™

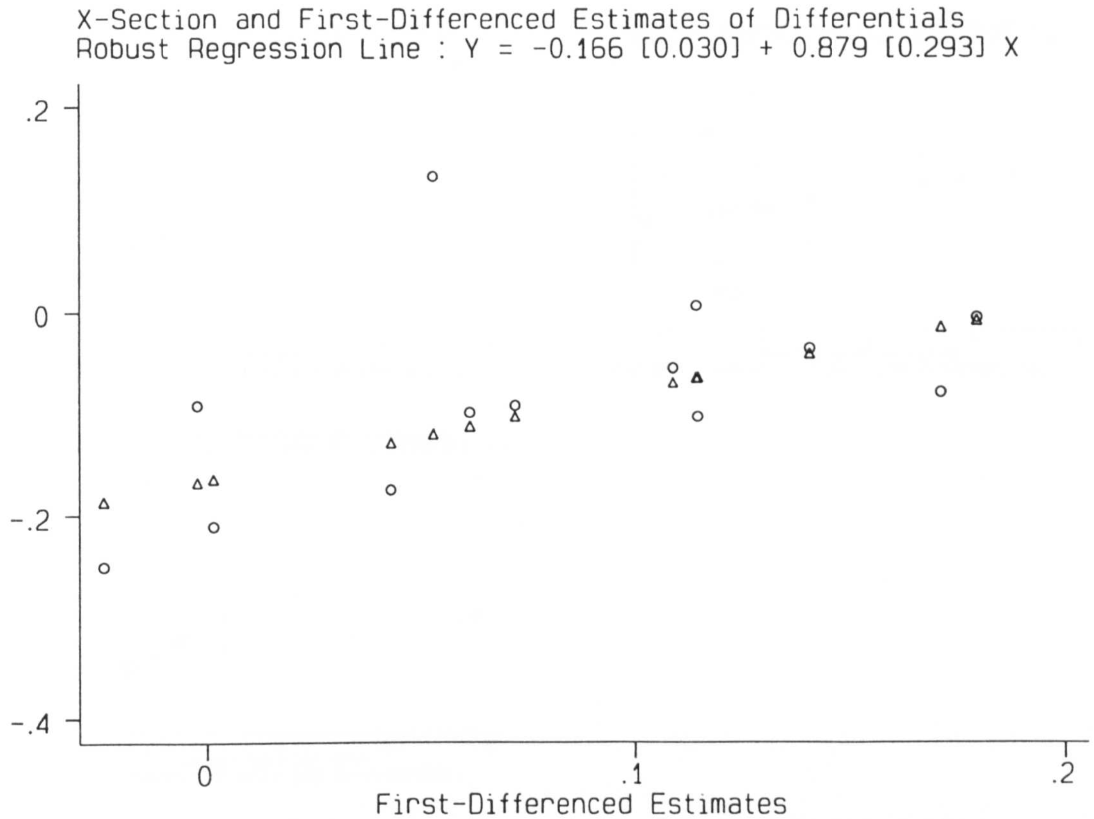


Fig 5 : Comparison of Estimates

STATA™

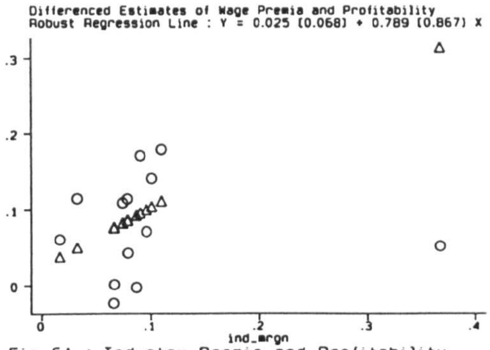


Fig 6A : Industry Premia and Profitability

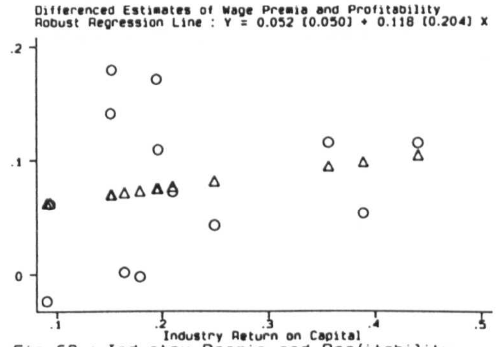


Fig 6B : Industry Premia and Profitability

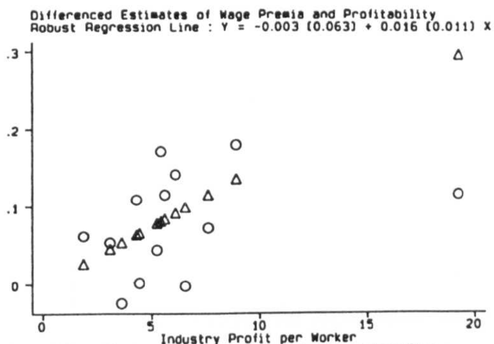


Fig 6C : Industry Premia and Profitability

Fig 6 : Differenced Estimates and Profitability

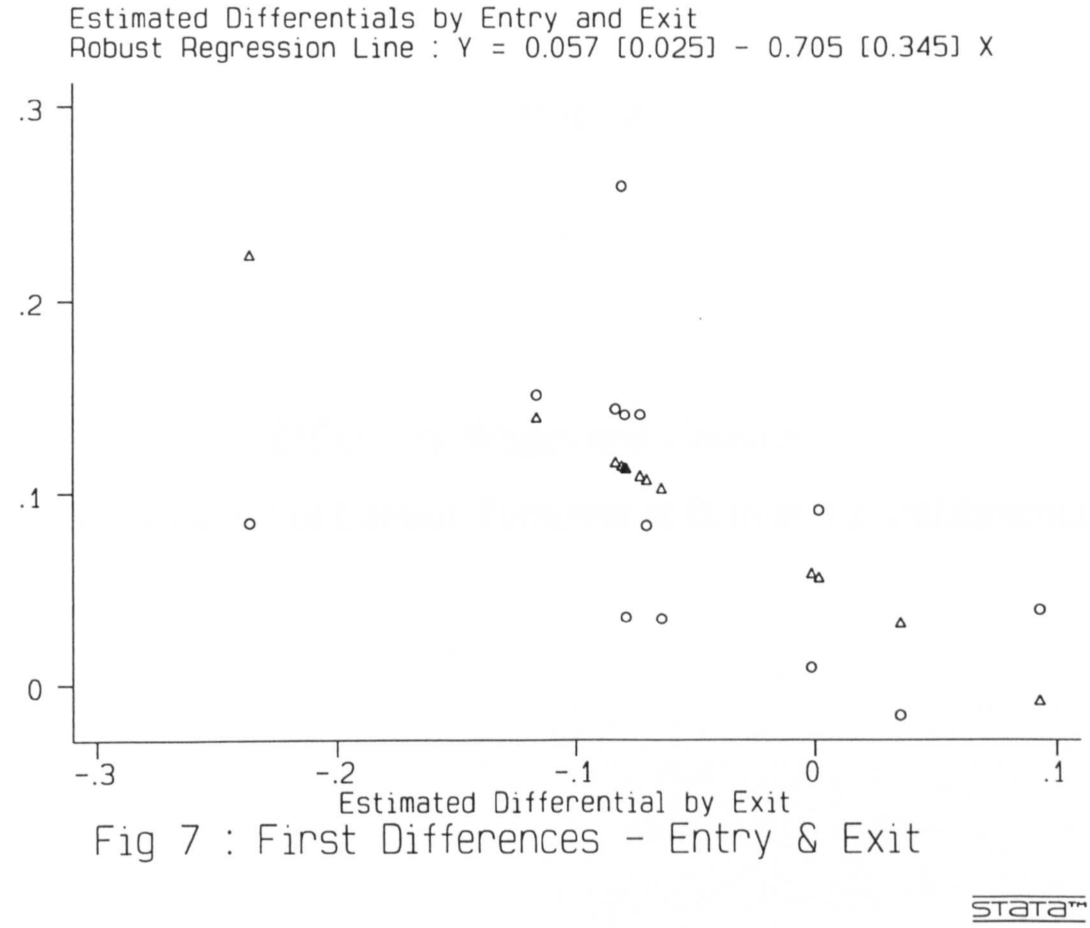


Fig 7 : First Differences - Entry & Exit

Chapter 4

Efficiency Wages and Unionism
In An Analysis of Labour Turnover at British Establishments

Abstract : The Chapter considers the determination of wages and turnover, applying the analysis to a sample of establishments from the Workplace Industrial Relations Survey of 1990. Estimation results suggest that turnover is negatively related to wage levels and union presence and a negative relation exists between wages and local unemployment. Additional results include that recognition has a negative effect upon turnover only for levels of density above 50 % and that the closed shop 'effect' appears to proxy that resulting from high levels of union density at the establishment.

1 Introduction

Labour turnover plays a central role in both the pricing and allocation of labour. In part quits and separations are key determinants of the process of labour market adjustment - but at the same time may impose significant costs upon both employers and employees. Moreover, an analysis of labour turnover provides a context for assessing the significance of at least two theories with important consequences for the efficient functioning of labour markets.

First, the efficiency wage model of Salop (1979) suggests the use of the wage rate as an instrument for reducing employee-initiated separations and avoiding the associated labour turnover costs. Relatedly, the fact that the employer may influence labour supply to the firm through its setting of the wage rate implies that the competitive model of the labour market is not strictly valid. Second, the central prediction of the exit-voice model of trade unions is that union presence has a significant negative effect upon quits and job separations - and that this effect is independent of any monopoly wage gains which union presence may imply (Freeman, 1980). Despite this importance which one might assign to the determination of turnover rates, there are few micro-level studies which focus upon these issues for Great Britain. At the same time, studies of the effects of trade unions typically focus upon the wage gap associated with trade union presence. However, this literature appears to indicate that union wage effects in Great Britain are likely to be rather modest. As such, it seems both appropriate and necessary to consider wider aspects of the consequences of trade union activities.

The rest of the Chapter is organised as follows. Section 2 outlines the theoretical considerations which provide a basis to the empirical work undertaken. The simple model introduces wage bargaining into the standard efficiency wage turnover model. Section 3 describes the empirical estimation and results for our analysis of turnover and wages. Concluding remarks are offered in Section 4.

2 Theoretical Considerations

Bargaining in an Efficiency Wage Turnover Model

In this section we present a simple theoretical model which introduces wage bargaining into the conventional efficiency wage model of Salop (1979). As will become clear, it may be considered a generalisation of Salop's (1979) model.

The introduction of wage bargaining into the turnover model might be considered important in a number of respects. First, at a general level, bargaining is widely considered an influence in the determination of wages such that we might reasonably expect its presence to be felt alongside any efficiency wage considerations. Second, previous empirical studies of quits and wages which derive predictions on the basis of the standard theoretical model (e.g. Campbell, 1993) do so by stating the quit rate to be a function of a number of variables, conduct comparative statics on this basis and then go on to suggest that we might also anticipate union presence to have a negative effect upon quits for reasons of voice. However, if this is the case then the theory presented by Campbell (1993) would lead us to expect a *negative* relation between wage levels and union presence. That is, the lower quit rate resulting from union voice reduces the profit-maximising wage to be paid as part of the employer's optimal wage / quit combination. Of course we know that wage levels tend to be positively related to union presence. Presumably, this is for reasons of bargaining such that it would appear worthwhile to introduce bargaining into the model and, at the same time, allow a more formal statement of the voice effect of union presence. Finally, we would argue that introducing wage bargaining is of importance due to a result which we derive, and comment upon more fully, below.

Taking layoffs to be assigned randomly across workers, the union maximises the welfare of the representative member. Assuming also risk-neutrality, the union objective is given by :

$$V_i = S_i(q,W)W_i + (1 - S_i(q,W))\overline{W} \qquad (1)$$

where W is the establishment wage and $\overline{W}$, the expected income of the displaced worker which we will also assume to be the union status quo point during bargaining; S_i denotes the probability of remaining at the establishment which is a function of the quit rate q(.) as well as the wage, W.

Firm Profits, (π), are given by revenues, (R), minus costs where the latter consist of employment costs (WN) and labour turnover costs, (θqN), where θ denotes the per worker turnover cost.

$$\pi_i = R(N_i) - N_i \left[W_i + \theta\, q(W_i, \overline{W}, U, v)\right) \tag{2}$$

such that the quit rate at the establishment is, inter alia, a function of the unemployment rate, (U), and presence of voice (v).

In the standard (i.e. non-bargaining) case Equation 2 is the maximand (see Salop, 1979; Campbell, 1993). In a more general treatment we set up the bargaining and efficiency wage issue as the solution to the following Nash Product :

$$\Omega_i = \left\{\{U(W_i) - U(\overline{W})\}S(q, W_i)\right\}^{\beta} \left\{R(N_i) - N_i \left[W_i + \theta\, q(W_i, \overline{W}, U, v)\right]\right\}^{1-\beta} \tag{3}$$

where we have set the status-quo point of the employer equal to zero. We treat the bargain in the manner of a Right-to-Manage Model (see Nickell and Andrews, 1983) and maximise Equation 3 over the wage, W, subject to the labour demand curve, $\pi_N = 0$.

Taking logs of Equation 3 and differentiating with respect to the wage, W,

$$\frac{d\log\Omega_i}{dW_i} = \frac{\beta U'(W)}{U(W) - U(\overline{W})} + \frac{\beta S_W(q, W_i)}{S(q, W_i)} - \frac{(1-\beta)N}{\pi_i}\left\{\theta q_w(.W, \overline{W}, U, v) + 1\right\} = 0 \tag{4}$$

Using the Taylor-Series Approximation $U(\overline{W}) \cong U(W) + U'(W)(\overline{W} - W)$, we arrive at :

$$\frac{\beta}{W_i - \overline{W}} + \frac{\beta S_W(q,W_i)}{S(q,W_i)} - \frac{(1-\beta)N_i}{\pi_i}\left(\theta q_w(W,\overline{W},U,v)+1\right) = 0$$

(5)

Equation 5 is our first-order condition under bargaining in an efficiency wage turnover model, with second-order condition $\Omega_{WW} \langle 0$. Moreover, our first-order condition emerges as a generalisation of the conventional, non-bargaining story. Thus if $\beta = 0$, workers have zero bargaining power over wages and the model specialises to the case considered by Salop (1979). In such a case, we can see from Equation 5 that we arrive at the first-order condition

$$-\theta q_w = 1 \tag{6}$$

which is that obtained by Salop (1979) and Campbell (1993).

More generally however, where $0 \leq \beta \leq 1$, then

$$-\theta q_w \leq 1$$

In effect, the wage is being bargained to a level beyond what would otherwise be the case in the absence of bargaining, such that at the optimum, quits are less responsive to wages. This is a significant point since empirical studies have generally found a significant wage effect upon quits - but one which does not imply that paying wages above the market-clearing rate would 'pay for itself' (given certain assumptions regarding the magnitude of the per-worker labour turnover cost, θ). This has been interpreted by some critics of efficiency wage theory (e.g. Leonard, 1987) as evidence against the approach. Somewhat similarly, Campbell (1993; p. 459) maintains that "The low value of θq_w is incompatible with an efficiency wage model in which firms maximise short-run profits and in which turnover costs play a significant role". Instead, Campbell suggests the results may be more consistent with an efficiency wage model where firms maximise long-run profits (with future productivity depending upon current wages) or with stronger effects from wages to effort levels. As a response, and following the result derived above, we could argue that it equally points towards the presence of bargaining considerations *alongside* those of efficiency wages. It also mirrors the similar result of Layard *et al.*, (1991; p.540), who show that the introduction of bargaining into the Shapiro-Stiglitz shirking model of efficiency wages, implies that the elasticity of effort with respect to the wage may be less than unity, a modification of the standard unit elasticity result.

Equation 5 may also be expressed as a wage mark-up equation. We define the absolute survival elasticity as, $\eta_{SW} = -\dfrac{W_i S_i(q, W_i)}{S(q, W_i)}$,

$$\frac{W - \overline{W}}{W} = \left\{ \eta_{SW} + \left(\frac{1-\beta}{\beta} \right) \frac{WN}{\pi} \left(1 + \theta\, q_W \left(W, \overline{W}, U, v \right) \right) \right\}^{-1} \tag{7}$$

The wage gain over the outside alternative is a function of the survival elasticity, the relative bargaining strength of employees, profit-per-employee, labour turnover costs and the responsiveness of quits to wages at the establishment.

Analysis of comparative statics of Equation 7 produces the following predictions :

$$\frac{dW}{d\beta} > 0 \qquad\qquad \frac{dW}{dU} >< 0$$

whilst the model also assumes :

$$\frac{dq}{dW} < 0 \qquad\qquad \frac{dq}{dU} < 0 \qquad\qquad \frac{dq}{dv} < 0$$

The effect of unemployment upon wages is of indeterminate sign a priori. There are two opposing forces at work here. First, as unemployment rises this makes workers less likely to quit their jobs such that the firm can pay a lower wage to attain any given quit rate. This tends to generate an inverse relation between wage levels and local unemployment. Second, in making workers less likely to quit, union preferences attach greater weight to the current wage rather than the threat point as part of the bargain. In practice, we might well expect the former effect to dominate. Thus a negative association between wages and unemployment comes about because unemployment discourages quits. Hence, in regions with relatively high unemployment, quits are ceteris paribus lower, and the optimal wage-offer will also be lower. Clearly we might choose to consider the relative bargaining strength of workers, β , or fallback position, $\overline{W}$, to be a negative function of the unemployment rate (Svejnar, 1986; Blanchflower, 1991). Again a negative relation between wages and local unemployment would result, in this case for reasons of bargaining. Thus the model touches upon two of the main approaches which attempt to provide a rationale for the 'Wage Curve' (Blanchflower and Oswald, 1994, Chapter 3) but in a somewhat different manner. At the same time it is worth emphasising that most studies of union effects consider either union wage effects, or voice effects whereas our analysis encompasses both bargaining and voice aspects of union activities.

3 An Empirical Analysis of Labour Turnover at British Establishments

We now go on to assess the empirical merit of the suggestions outlined in the previous section by providing an analysis of the determination of turnover and wage rates, to be estimated on the sample of British private and public sector establishments contained in the 1990 Workplace Industrial Relations Survey.

Prior to discussing a number of data issues which arise in the present study, we begin by discussing previous empirical work in this area. Alongside the industry-level analysis of Shorey (1980) a small number of studies employing microdata for Great Britain exist[1] .

Individual-level studies are provided by Shah (1985) and Stewart (1988) with establishment-level evidence offered by Wilson and Peel (1991) and Fernie and Metcalf (1995). A case can be made for arguing that the level of aggregation in empirical work should meet the level of aggregation implicit in the issues with which one is concerned. Thus in terms of the relation between levels of turnover and wages, individual-level studies are concerned with matching behaviour of individuals to age-earnings profiles according to their individual propensity to quit. In contrast, as noted by Campbell (1993), efficiency wage theory is essentially concerned with the

1 For United States evidence see, inter alia, Freeman (1980), Leonard (1987) and Campbell (1993)

behaviour of firms. As such it is at the establishment- or firm-level which is the appropriate level of aggregation. Wilson and Peel (1991) provide an analysis of 52 engineering firms in the U.K. and find evidence of significant negative union effects upon turnover. The paper fails to find evidence of a significant effect from wage levels to turnover[2] . The limited sample on which the study is based might also lead to a questioning of the extent to which one may be able to generalise on the basis of such results. The study of Fernie and Metcalf (1995) is more particularly concerned with the effects of a range of worker representation variables upon a number of outcomes which include the establishment quit rate. Their analysis of the union effects does not control for the wage at the establishment and provides little guide as to the quantitative effects of union variables upon rates of turnover (reporting levels of statistical significance alone).

One further way in which these studies differ is in regard to an attempt to address the potential endogeneity of the wage. Typically, these studies do not treat the wage as endogenous to the turnover equation whereas those which do (Shorey, 1980; Shah, 1985; Stewart, 1988) employ questionable exclusion restrictions, the validity of which goes untested. Examination of our present dataset does not reveal any convincing instruments for the wage such that, in a similar manner to the studies of Leonard (1987) and Campbell (1993) with which the present Chapter has most in common, we do not allow for the potential endogeneity of the wage rate. This is a weakness of the analysis, albeit one which is by no means unique to this study.

Data Issues

The data source employed in the present Chapter is the British Workplace Industrial Relations Survey of 1990 (WIRS 1990). The dataset represents a representative sample of establishments with at least 25 employees within Great Britain. The sampling frame consisted of the 1987 Census of Employment covering all manufacturing and services for both public and private sectors with the single

2 The paper also considers rates of absenteeism. Although this analysis also indicates an insignificant relation with the wage rate, in a Seemingly Unrelated Regressions model for rates of turnover and absenteeism, the wage emerges as a significant determinant of the quit rate.

exception of deep coal-mining. From this sampling frame an achieved sample of 2061 establishments was obtained, covering over 1.1 million employees in total (see Millward *et al.*,1992).

In common with previous studies of wages using the present dataset (e.g. Blanchflower *et al.*, 1990) we must address the fact that the available wage data is grouped. Stewart (1983) shows that the common practice of assigning mid-points to the intervals (and equally ad hoc values to the open-ended categories) and applying least squares, will not in general provide consistent estimates. In the present Chapter, we therefore adopt the recommended maximum likelihood procedure for such circumstances. The same method is employed by Stewart (1995) in order to estimate manual wage equations for the 1990 WIRS sample of private sector establishments.

The wage data is stratified by skill group whereas the majority of establishment characteristics, including the quit rate and separations rate, are measured at the establishment-level. Hence for the purpose of estimating our quits and separations models we construct an establishment-level wage. This is given as the weighted average of the available wage rates by skill group for the establishment, the weights being given by the relative employment levels corresponding to each skill group. We use all five (manual and non-manual) wages in order to do so, employing a subset of these if the reason for a missing wage is that there are four or fewer employees in that skill category (in which case a wage rate is not requested from the establishment for that skill group).

A number of establishments report a zero number of quits over the year in question. Given that our models are estimated in log odds form, appropriate for proportions data, we employ the Cox correction to the log transformation for such circumstances (see Cox and Snell, 1989).

The vector of control variables used in our analysis essentially follows from Stewart (1995). However, since we choose not to restrict the analysis to private sector establishments we also include a dummy variable indicating public sector status. We also include a set of industry dummies at the two-digit level.

The use of establishment-level data which sums across 'n' workers at each plant in order to examine the quit rate might be expected to be especially susceptible to heteroskedasticity. For this reason, we test for heteroskedasticity, employing the

Koenker (1981) LM Test, reported alongside a test for functional form in the manner of Ramsey's (1969) RESET Test.

Finally, the clear conceptual distinction between quits and dismissals may not be quite so clear in practice as either side to the employment relation may face financial incentives to declaring a separation as being in one form rather than the other. For instance, individuals may face penalties in terms of benefit eligibility following a voluntary quit; employers may also face lower turnover costs if they are able to induce a quit on the part of the employee rather than attempting to dismiss him or her. Thus we re-estimate our quits equations for data on total separations which we define as the sum of quits and dismissals.

Table 1 contains some raw data concerning variations in rates of quits and separations between establishments with different characteristics in terms of worker representation and levels of pay. It is clear from Table 1 that unionised establishments appear to experience lower rates of turnover than non-unionised establishments. The separations rate at establishments which recognise a union for bargaining purposes is 11.8 % compared to a turnover rate of 17.7 % at those which do not. Perhaps of interest is the observation that the difference between establishments with high and low levels of union density appears marginally greater than the difference between establishments with and without a closed shop. The difference between establishments which possess a joint consultative committee (JCC) and those which do not is also less pronounced than differences on the basis of union recognition. We may note that the consequences of these differences between unionised and non-unionised establishments may include the provision of training, an argument on which Green, Machin and Wilkinson (1996) draw in explaining their finding of enhanced training provision in unionised establishments. Establishments paying above the median experience lower rates of turnover to those paying less than the median across the set of establishments. However, clearly the issue is whether such differences are maintained when the ceteris paribus condition is imposed.

Estimation Results

Given that our model makes certain predictions regarding the determination of wages, we report estimated earnings equations for manual and non-manual wages in Tables 2a and 2b. Prior research leads us to anticipate a positive employer size-wage effect (Brown and Medoff, 1989; Green, Machin and Manning, 1996) whilst we expect to observe a depressing influence of the local unemployment rate upon pay (Blanchflower and Oswald, 1994) and positive association between union presence and wage levels.

The results are consistent with our a priori expectations. There is evidence of a positive establishment size - wage differential. Local unemployment depresses pay levels by a magnitude consistent with the results of Blanchflower and Oswald (1994). Evidence for a union wage effect by recognition is found for unskilled manuals of 9% with a further differential for the presence of a closed shop also being estimated.

Turning to our quits equation which we estimate in log odds form, appropriate for proportions data, previous studies (mainly for the United States) indicate that the quit rate tends to decline in establishment or firm size. In our own analysis this relation is maintained when we control for the wage rate, suggesting that the size - quit relation is observed not only because large establishments and firms pay higher wages. Note that this has the further implication that in terms of an explanation for the establishment size - wage differential, this cannot be explained by the recruitment of higher quality individuals by large establishments (see Brown and Medoff, 1989; Green, Machin and Manning, 1996).

As noted in Section 2, we also expect to observe a negative relation between quit rates and unemployment. Voice is represented by a number of variables which centre on union presence and the presence of a joint consultative committee (JCC). The forms of union presence considered include (manual or non-manual) union recognition, a closed shop / management recommendation of union membership and union density; The definition of the closed shop variable follows from the discussion and results of Stewart (1995) (see also Machin and Stewart, 1996) in treating those establishments which recommend membership to all or some employees as possessing a *de facto* closed shop. In the context of labour turnover, a test of the reasonableness of the proposed merging of management recommendation of membership and a pre-entry / post-entry closed shop term suggested this was a legitimate procedure. Thus coding a variable equal to +1 if there exists a pre- / post- entry closed shop; -1 if management recommends membership to all or some employees and zero otherwise produced a coefficient (standard error) of 0.028 (0.080) in the quits equation and of 0.073 (0.079) in the estimated equation for total separations.

The results indicate that union recognition reduces total separations (but is insignificant in the equation for quits alone) with a stronger relation emerging from the existence of a closed shop. The presence of a joint consultative committee appears to be unrelated to turnover. As Freeman (1980) suggests, some degree of bargaining strength over and above mere consultation may be necessary for 'voice' to be observed.

Turnover is lower where unemployment is relatively high as we would expect from our model and this may contribute to explaining the negative relation between pay levels and local unemployment. The results in Table 3 indicate that quits and separations are negatively related to wage levels which we take as support for the main prediction associated with the efficiency wage approach. Taking a point estimate of -0.0024 as representative of the results implies an elasticity of the turnover rate with respect to the wage of -0.24, evaluated at the mean[3] and compares to an estimated elasticity of the rate of turnover with respect to the local unemployment rate of -0.22. The results imply that a 10 % increase in weekly earnings will reduce turnover by 2.4 % or 0.4 percentage points. In terms of the labour turnover costs which are imposed upon an employer, then clearly these vary considerably by skill category. Nevertheless, taking a cost of several thousand pounds per worker as representative indicates that there are significant benefits associated with paying wage

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[3] The elasticity of the turnover rate with respect to a variable, X that is measured in levels may be derived as $\eta = \dfrac{\beta_i X}{1+\exp(\beta_i X)}$; where a regressor is in logs, $\eta = \dfrac{\beta_i}{1+X^{\beta}}$, where β_i denotes the point estimate on the regressor.

premia in terms of reduced turnover, although such a wage increase would by no means pay for itself[4] .

As noted above the union recognition effect falls short of statistical significance in the quits equation but is significant in the analysis for total separations. The closed shop effect is also statistically significant. We now turn to a finer analysis of the union effects upon turnover in order to consider in greater detail the nature of the recognition and closed shop effects of trade union organisation upon turnover.

Table 4 presents summary statistics on levels of density by various categories of union status. In Table 5 we employ these categories in order to look for threshold effects in the relation between turnover and union recognition according to levels of union density. Conducting a search over the appropriate definition of the thresholds then produced the preferred results presented as columns 2 and 4 of Table 5. Two striking results emerge from Table 5. First, union recognition has a significant negative effect upon turnover solely for levels of membership in excess of approximately 50 % of the establishment. This is the case in 69 % of establishments which recognise a trade union but do not possess a closed shop (Table 4). Thus density appears to matter for a recognition effect to be present. In terms of the exit-voice model then, this seems to accord with the view that for the individual union member it is, at least in part, membership of a union which dictates his / her access to the grievance and arbitration system through the trade union. It is interesting to note that Freeman and Medoff (1984) argue that individual use of the collective voice mechanism is likely to depend upon anonymity. Levels of union membership may in fact act as a proxy for anonymity and hence willingness to employ the union grievance and arbitration system.

The results indicate that relative to an establishment which does not recognise a trade union, an establishment with recognition and density above 50%, has a quit rate approximately 25 % lower, or a full 4 percentage points. It seems highly plausible that such differences should have an appreciable impact upon, inter alia, the provision of training.

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4 Campbell (1993) refers to the study by the M&M Association (1980) which estimates the per worker cost of turnover to be approximately \$3600 for production workers, \$2300 for office and technical workers and \$10400 for salaried employees.

Second, the effect of recognition at relatively high levels of density is similar in magnitude to that associated with the presence of a *de facto* closed shop. Thus it appears that the lower levels of turnover associated with the presence of a closed shop are likely to be a result of the high levels of density which the presence of a closed shop implies. This result is also of interest in view of the aim of understanding the nature and effects of the closed shop in general. Metcalf and Stewart (1992) make this point and assess the impact of the closed shop upon the relative pay of semi-skilled manuals using WIRS 1984, observing an effect of the pre-entry closed shop in its own right whereas the post-entry closed shop appears to essentially have a density effect alone. At least following the successive rounds of legislation aimed at removal of the closed shop, it appears that in its effectiveness as a voice institution, a *de facto* closed shop does not have any effect over and above that associated with high density. One point of caution is however necessary since these results may at least in part reflect another potential force at work which is quite unrelated to notions of voice. Thus membership levels and rates of turnover may be inversely related if recruitment of potential members is made more difficult in establishments with high rates of turnover.

Further analysis of the relationship between turnover and trade unions produced additional results. First, we consider whether the effect of a closed shop also varies according to the level of density present. Thus partitioning the closed shop variable according to whether the establishment also has a level of density greater than or equal to 85 % (the median level of density for those establishments which possess a closed shop) results in a coefficient (standard error) on the closed shop, density less than 85% term of -0.190 (0.138) and on the variable indicating a closed shop with density greater than or equal to 85 % of -0.497 (0.146) in the quits equation[5] . This would also appear to be consistent with the view that the closed shop variable is picking up a density effect since when density is relatively low, a significant relation between turnover and the closed shop term is not observed.

[5] The corresponding coefficients (standard error) in the separations equation are -0.192 (0.136) and -0.643 (0.146) respectively.

Second, we also consider whether membership in the absence of recognition is related to turnover through the addition of a corresponding dummy variable to the specifications reported as columns 2 and 4 of Table 5. Our results indicate no such effect from membership alone, with the coefficient (standard error) on this term being 0.073 (0.130) and 0.003 (0.129) in the quits and separations results respectively. The results for the other union variables, indicating effects relative to an establishment with no union members are quantitatively similar to those reported in columns 2 and 4 of Table 5.

4 Conclusions

The Chapter has considered the determination of rates of labour turnover and wages in a cross-section of British establishments. The motivation for so doing was provided by an efficiency wage model. The main focus of attention was upon the wage and trade union effects upon turnover. The results obtained were found to be consistent with our a priori expectations.

Rates of turnover are inversely related to the wage at the establishment with an elasticity of the annual rate of turnover of -0.24. This is consistent with the main prediction of the efficiency wage model in which the introduction of bargaining implies that wage premia may no longer be expected to pay for themselves. Relatedly, we also note that a significant wage effect upon turnover is also a key assumption of certain wider theories of the labour market (e.g. theories of unemployment, Phelps, 1994; and models of dynamic monopsony (e.g. Green, Machin and Manning, 1996).

Indicators of union presence, in the form of a closed shop and union recognition were found to have a negative effect upon rates of turnover. However there is much variation around these overall effects. Our results indicated that much of this variation turns upon the levels of union membership at the establishment. Thus recognition only appears to be significantly inversely related to turnover if the majority of the establishment's employees are union members. This is the case in 69% of establishments which recognise a trade union (and do not posses a closed shop). Such circumstances, i.e. union recognition and density in excess of 50 %, imply a 25 % lower quit rate, ceteris paribus, relative to an establishment which does not recognise a trade union. The relation between turnover and the presence of a closed shop does not appear to result from the closed shop as representing an institutional device in its own right but instead appears to follow from the high levels of density which accompany the presence of such an arrangement. Thus the recognition effect upon turnover at high levels of density was estimated to be similar in magnitude to that associated with the closed shop. In addition, it was found that the closed shop variable is only significantly related to turnover if accompanied by relatively high levels of union density.

In general the results have attempted to demonstrate the importance of wages and trade union presence as influences upon levels of turnover experienced at British workplaces. As such these mechanisms may offer important routes through which employers and unions may alter the patterns of turnover experienced by establishments. This may have important consequences for the way we perceive the determination of wages as well as the economic effects of trade unions.

Table 1 : Turnover, Unions and Wages		
	Quit Rate	Separations Rate
Recognition	0.110 (0.122)	0.118 (0.120)
Non-recognition	0.149 (0.152)	0.177 (0.168)
Closed Shop	0.098 (0.115)	0.109 (0.122)
Open Shop	0.135 (0.142)	0.154 (0.153)
High Union Density	0.101 (0.100)	0.111 (0.106)
Low Union Density	0.155 (0.160)	0.189 (0.176)
JCC	0.119 (0.122)	0.134 (0.129)
JCC absent	0.133 (0.145)	0.152 (0.155)
High Wage	0.119 (0.137)	0.136 (0.150)
Low Wage	0.139 (0.145)	0.161 (0.162)
All	0.148 (0.234)	0.168 (0.254)

Notes :

1. Summary statistics for all establishments which contain relevant data.
2. standard deviations in parentheses.
3. closed shop variable defined in terms of Pre- or post-entry closed shop or management recommends membership.
4. high / low levels of density or wages are defined relative to median values.

Table 2a : Maximum Likelihood Estimates of Wage Equations for Manual Workers

	Unskilled	Semi-skilled	Skilled
$50 < \text{employees} \leq 100$	-0.051 (0.024)	0.031 (0.025)	-0.036 (0.020)
$100 < \text{employees} \leq 200$	-0.005 (0.030)	0.059 (0.030)	0.016 (0.026)
$200 < \text{employees} \leq 500$	0.039 (0.040)	0.144 (0.039)	0.008 (0.033)
$500 < \text{employees} \leq 1000$	0.035 (0.061)	0.092 (0.062)	-0.004 (0.051)
$1000 < \text{employees}$	0.119 (0.088)	0.157 (0.081)	0.092 (0.067)
log $(\text{unemployment})_{ttwa}$	-0.106 (0.018)	-0.048 (0.018)	-0.059 (0.015)
manual union recognition	0.088 (0.026)	-0.014 (0.028)	-0.034 (0.022)
closed shop	0.133 (0.030)	0.047 (0.029)	0.106 (0.023)
controls			
majority skill group male	0.323 (0.030)	0.150 (0.034)	0.198 (0.036)
proportion manual	0.261 (0.058)	0.062 (0.062)	-0.151 (0.048)
proportion skilled	-0.093 (0.052)	-0.220 (0.046)	-0.163 (0.031)
proportion part-time	-0.525 (0.065)	-0.230 (0.073)	-0.315 (0.069)
proportion female	-0.065 (0.070)	-0.563 (0.079)	-0.200 (0.063)
single independent estab.	-0.008 (0.025)	0.003 (0.025)	0.041 (0.020)
shift-work	-0.004 (0.023)	0.049 (0.024)	-0.033 (0.019)
UK-owned	-0.139 (0.041)	0.007 (0.034)	-0.036 (0.026)
employers' association	0.002 (0.036)	-0.070 (0.033)	0.048 (0.022)
public sector	0.106 (0.086)	-0.034 (0.077)	-0.030 (0.069)
JCC	0.070 (0.021)	0.022 (0.024)	0.021 (0.019)
constant	4.564 (0.087)	4.891 (0.107)	5.485 (0.087)
industry dummies (two-digit)	$\chi^2(49) = 200.44$ [p=0.000]	$\chi^2(50) = 153.97$ [p=0.000]	$\chi^2(50) = 153.64$ [p=0.000]
Model χ^2	$\chi^2(70) = 1042.24$ [p=0.000]	$\chi^2(71) = 685.26$ [p=0.000]	$\chi^2(71) = 792.13$ [p=0.000]
Log likelihood	-1712.858	-1463.190	-1538.009
σ	0.262 (0.006)	0.238 (0.006)	0.202 (0.005)
sample size	968	785	864

Notes to Table 2a :

1. Dependent variable is log(typical weekly earnings) of majority gender in each skill group with 5 or more employees.
2. Asymptotic standard errors in parentheses
3. Data is weighted to account for non-random sampling from the size distribution of UK establishments.

4. regressions also include a dummy variable indicating missing data on UK owned variable (see Stewart, 1995).

Table 2b : Maximum Likelihood Estimates of Wage Equations for Non-manual Workers

	Clerical	Supervisors
50 < employees ≤ 100	0.031 (0.018)	0.143 (0.037)
100 < employees ≤ 200	0.086 (0.021)	0.194 (0.037)
200 < employees ≤ 500	0.099 (0.027)	0.197 (0.038)
500 < employees ≤ 1000	0.113 (0.041)	0.150 (0.048)
1000 < employees	0.161 (0.056)	0.200 (0.058)
log (unemployment)$_{ttwa}$	-0.081 (0.013)	-0.036 (0.017)
non-manual union recognition	-0.023 (0.023)	-0.041 (0.025)
closed shop	0.036 (0.028)	0.067 (0.032)
controls		
majority skill group male	0.185 (0.025)	0.094 (0.025)
proportion manual	0.008 (0.035)	-0.124 (0.043)
proportion skilled	0.025 (0.027)	0.033 (0.037)
proportion part-time	-0.527 (0.051)	0.339 (0.066)
proportion female	-0.067 (0.046)	-0.643 (0.067)
single independent estab.	0.037 (0.018)	0.047 (0.029)
shift-work	-0.040 (0.016)	0.024 (0.021)
UK-owned	-0.049 (0.022)	-0.012 (0.030)
employers' association	-0.024 (0.023)	-0.003 (0.028)
public sector	-0.079 (0.059)	-0.141 (0.061)
JCC	0.028 (0.017)	-0.038 (0.020)
constant	5.215 (0.054)	5.678 (0.084)
industry dummies (two-digit)	$\chi^2(49) = 128.34$ [p=0.000]	$\chi^2(49) = 337.43$ [p=0.000]
Model χ^2	$\chi^2(70) = 483.59$ [p=0.000]	$\chi^2(70) = 650.51$ [p=0.000]
Log likelihood	-1971.324	-1401.915
σ	0.203 (0.005)	0.210 (0.006)
sample size	1076	787

Notes :
as for Table 2a.

Table 3 : Labour Turnover at British Establishments

	Quits	Total Separations
ln (unemployment)$_{ttwa}$	-0.389 (0.064)	-0.336 (0.063)
union recognition only	-0.099 (0.093)	-0.182 (0.093)
closed shop	-0.263 (0.109)	-0.355 (0.109)
JCC	-0.049 (0.083)	0.061 (0.083)
wage*	-0.021 (0.009)	-0.029 (0.009)
$50 <$ employees ≤ 100	0.156 (0.085)	0.192 (0.085)
$100 <$ employees ≤ 200	-0.102 (0.113)	-0.080 (0.112)
$200 <$ employees ≤ 500	-0.213 (0.153)	-0.188 (0.153)
$500 <$ employees ≤ 1000	-0.550 (0.263)	-0.559 (0.267)
$1000 <$ employees	-0.291 (0.382)	-0.127 (0.399)
controls		
proportion manual	-0.431 (0.172)	-0.279 (0.170)
proportion skilled	-0.148 (0.126)	-0.233 (0.125)
proportion part-time	-0.128 (0.233)	-0.333 (0.229)
proportion female	0.023 (0.256)	0.055 (0.253)
single independent estab.	-0.156 (0.089)	-0.130 (0.088)
shift-work	0.336 (0.079)	0.269 (0.078)
UK-owned	-0.013 (0.129)	0.022 (0.128)
employers' association	0.142 (0.121)	0.160 (0.120)
proportion change. in employment	0.508 (0.099)	0.540 (0.097)
public sector	-0.196 (0.296)	-0.244 (0.292)
constant	-1.388 (0.406)	-1.250 (0.403)
industry dummies (two-digit)	F (51, 1016) = 3.93 [p=0.00]	F (51, 988) = 3.95 [p=0.00]
Diagnostics :		
Functional Form ; RESET [$\chi^2(1)$]	0.13	0.43
Heteroskedasticity ; Koenker [χ^2 (1)]	0.21	0.48
Model F-statistic	F (77, 1016) = 4.99 [p=0.00]	F(77, 988) = 5.32 [p=0.00]
R-squared	0.274	0.293
R-bar squared	0.219	0.238
sample size	1094	1066

Notes :

1. regressions also include five dummy variables indicating whether the majority of each skill group is male and one dummy for missing data on the U.K. owned variable.
2. * indicates coefficient and standard error multiplied by 10.

Table 4 : Summary Statistics on Union Density By Recognition and Closed Shop

Density (%)	No Recognition	Recognition, No c/shop	Closed shop	All
zero	79.2	0	0	39.1
> 0 and ≤ 25	11.0	12.6	0.2	10.0
> 25 and ≤ 50	3.0	18.3	10.2	9.3
> 50 and ≤ 75	3.8	31.5	20.6	16.2
> 75 and ≤ 100	2.9	37.6	69.0	25.4
Total (%)	100.0	100.0	100.0	100.0

Table 5 : Turnover and Trade Unions

	Quits		Separations	
	(1)	(2)	(3)	(4)
union recognition, no closed shop, density :				
density ≤ 25 %	0.478 (0.181)		0.170 (0.186)	
25% < density ≤ 50%	0.156 (0.164)		0.176 (0.162)	
50% < density ≤75%	-0.352 (0.134)		-0.358 (0.133)	
75% < density ≤ 100%	-0.342 (0.136)		-0.422 (0.135)	
density ≤ 29 %		0.472 (0.167)		
29% < density ≤ 54%		0.102 (0.163)		
54% < density ≤ 100%		-0.382 (0.113)		
density ≤ 50 %				0.174 (0.131)
50% < density ≤75%				-0.358 (0.133)
75% < density ≤ 100%				-0.422 (0.134)
closed shop	-0.312 (0.111)	-0.333 (0.111)	-0.388 (0.111)	-0.388 (0.111)
JCC	-0.054 (0.085)	-0.054 (0.085)	0.058 (0.085)	0.058 (0.085)
wage*	-0.021 (0.009)	-0.019 (0.009)	-0.029 (0.009)	-0.029 (0.009)
ln (unemployment)$_{ttwa}$	-0.359 (0.066)	-0.361 (0.066)	-0.314 (0.065)	-0.314 (0.065)
Diagnostics				
Functional Form ; [$\chi^2(1)$]	1.98	1.51	1.32	1.32
Heteroskedasticity;[χ^2 (1)]	0.01	0.01	1.40	1.40
Model F-statistic	F(78, 958)=5.22	F(77, 959)=5.33	F(78, 932)=5.40	F(77, 933)=5.48
R-squared	0.298	0.300	0.311	0.311
R-bar squared	0.241	0.244	0.254	0.255
sample size	1037	1037	1011	1011

Notes :

1. regressions also include the control variables in Table 3 and size dummies.

Table 5 (cont.) **:** Turnover and Trade Unions

	Quits		Separations	
	(5)	(6)	(7)	(8)
union members, no recognition.		0.073 (0.130)		0.003 (0.129)
Closed shop, Density :				
density ≤ 85 %	-0.190 (0.138)		-0.192 (0.136)	
density > 85 %	-0.497 (0.146)		-0.643 (0.146)	
union recognition, no closed shop, density :				
density ≤ 29 %	0.465 (0.169)	0.493 (0.167)		
29% < density ≤ 54%	0.090 (0.165)	0.104 (0.166)		
54% < density ≤ 100%	-0.410 (0.115)	-0.382 (0.121)		
density ≤ 50 %			0.163 (0.132)	0.163 (0.133)
50% < density ≤75%			-0.379 (0.134)	-0.392 (0.136)
75% < density ≤ 100%			-0.475 (0.137)	-0.458 (0.140)
closed shop		-0.332 (0.119)		-0.423 (0.118)
JCC	-0.071 (0.086)	-0.022 (0.085)	0.047 (0.087)	0.098 (0.085)
wage*	-0.018 (0.009)	-0.017 (0.009)	-0.026 (0.009)	-0.027 (0.009)
ln $(\text{unemployment})_{ttwa}$	-0.356 (0.068)	-0.332 (0.066)	-0.296 (0.067)	-0.279 (0.065)
Diagnostics				
Functional Form ; $[\chi^2(1)]$	1.10	1.67	1.10	1.65
Heteroskedasticity;$[\chi^2(1)]$	0.01	0.01	1.78	1.54
Model F-statistic	F(78,931)=5.19	F(78,944)=5.25	F(78,906)=5.39	F(78,918)=5.43
R-squared	0.303	0.302	0.317	0.316
R-bar squared	0.245	0.245	0.258	0.258
sample size	1010	1023	985	997

Notes :

1. regressions also include the control variables in Table 3 and size dummies.

Data Appendix

Appendix Table A.1 : SUMMARY STATISTICS

Table A.1 : Summary Statistics	
quit rate	0.127 (0.137)
separations rate	0.149 (0.154)
establishment wage (£ per week)	147.611 (57.76)
recognition (manual or non-manual), no c/shop	0.304
closed shop or management recommends membership.	0.196
employment	93.16 (199.64)
manual proportion	0.578, (0.297)
female proportion	0.444 (0.319)
part-time proportion	0.212 (0.251)
skilled proportion	0.267 (0.323)
UK owned	0.900
public sector	0.241
log (unemployment)$_{ttwa}$	1.536 (0.540)
JCC	0.251
proportionate change in employment	0.036 (0.329)
shift-work	0.407
employers'association	0.123
single independent estab.	0.274

Notes :

1. standard deviations in parentheses where applicable.
2. reported sample is restricted to those establishments employed in the Regression of Table 3, column 2 (n=1066).

Chapter 5

Wage Determination at the Firm-Level : Employees and Executives

Abstract : The implications of alternative approaches are contrasted for the determination of employee and executive pay and confronted with data for a sample of 375 manufacturing firms over the period 1984-94. Both estimation of the individual models and the results of non-nested tests favour a bargaining model at the employee level of the firm and competitive model subject to labour market frictions at the executive level.

1 Introduction

Much of the interest in executive labour markets and executive pay in particular has stemmed from the suspicion that the forces of wage determination differ at this level of the firm to those which apply at the employee level. Within the economics of wage determination more generally, firm-level approaches have been adopted to shed light upon the question of whether market-clearing, competitive models of wage determination accurately describe the labour market. The conclusion from this line of literature has been that a competitive approach is incomplete (see Oswald, 1995 and the references therein). Instead, wage determination is seen as reflecting a combination of inside (employer-level) and outside (market-level) forces, with ability to pay taking on a prominent role as an influence upon wage levels.

The approach adopted in such employee-level studies of wage determination stands in some contrast however, to that approach adopted in studies of executive-level pay. These latter studies, interest in which has also grown in recent years, given the marked growth observed in executive pay, have been largely motivated by agency theory and the need to motivate appointed managers to follow shareholder interests. There has been little, if any, mention of the possibility of bargaining being present at this level of the firm.

Do the forces of wage determination differ between levels of the firm ? The present Chapter takes this question as its central motivation. Moreover, in testing between competing models, we address the asymmetry which exists in the treatment of executive-level pay from that of employees in firm-level studies. Thus although we estimate executive pay equations in a similar manner to those which exist in the executive pay literature, we do so against a more general background of testing between competing models of wage determination.

The present Chapter is therefore set against a background of rising pay inequality (Machin, 1996) which has also been mirrored in the within-firm ratio of highest-paid director to average employee earnings (Conyon, 1996). The approach adopted in the present Chapter is to consider inter-firm variation in pay levels and how this varies between employee and executive levels of the firm, thus considering the determination of employee and executive pay in a comparable way. This allows us to examine whether the forces of wage determination revealed by such an analysis differs on the basis of the employee / executive distinction.

At the employee level, the main motivation for studies has been whether the competitive model accurately characterises the functioning of the labour market and the determination of wages, or whether, as in a bargaining model, the ability to pay of the firm matters. According to a competitive approach, there should exist no long-run relation between either profit-per worker or total profits and the wage paid by the firm. The finding of such prolonged effects from profits to wages has led to a questioning of competitive interpretations of wage determination.

At the executive level, the approach adopted has been motivated by agency theory (see Conyon *et al,* 1995), and the suggestion that pay determination will reflect the need to align the interests of appointed management to those of shareholders. Executive-level pay equations have therefore focused upon the sensitivity of pay to performance - measured by shareholder return - in order to consider the strength of the incentives for executives to follow shareholder interests.

Hence in what follows it is argued that the varying models argue for the importance of different factors in the estimation of firm-level wage equations. Thus the approach adopted in the present Chapter is to estimate the set of models at both the employee- and executive levels separately whilst also presenting the results of non-nested tests between the competing models.

The rest of the Chapter is organised as follows. Section 2 outlines the predictions of the theoretical approaches on which we draw as a basis for our empirical work. Section 3 describes the dataset with firm-level wage equations for both employees and executives being estimated alongside the associated non-nested tests. Concluding remarks are offered in Section 4.

2 Theoretical Background

In this section we summarise and briefly discuss the predictions which may be derived on the basis of alternative approaches to the determination of wages. These models have either provided the basis to previous studies of employee-level (e.g. Hildreth and Oswald, 1994) or executive- pay (e.g. Jensen and Murphy, 1990; Conyon and Leech, 1994) in firm-based panel data models. Note that we do not intend to offer the suggestion that these are the sole relevant candidate approaches to the determination of pay of employees and executives. In particular at the executive level, tournament theory (e.g. Main *et al,* 1993) and career concerns model (e.g. Gibbons and Murphy, 1992) offer important alternatives. However, these approaches offer predictions with greater relevance for the distribution of intra-firm pay or pay-performance link over the working life, and therefore lie beyond the scope of the current Chapter. We focus upon the following predictions on the basis of the alternative approaches to pay determination :

<u>Proposition 1</u> : The Nash Bargaining model predicts a positive relation between pay levels and profit-per-worker.

<u>Proposition 2</u> : According to a competitive model in which there are short-run supply frictions to labour mobility, there will exist a positive, short-run relation between pay levels and total profits.

<u>Proposition 3</u> : The agency approach, most commonly cited as a basis to studies of executive pay, predicts a positive relation between the level of pay and firm performance.

Discussion

Proposition 1 is derived from the relatively familiar Nash bargaining model which predicts, inter alia, a relation between the wage and profit-per-employee as employees are able to enjoy earnings in excess of the alternative by sharing in the per-worker rent. Despite its familiarity at the employee-level, its scope in contributing to one's understanding of executive pay does not appear to have been considered.

The prediction obtained on the basis of the competitive model subject to supply frictions, that is a positive short-run relation between pay levels and total profits, reflects the suggestion that if the individual firm faces an upwardly-sloped labour supply function, then demand or price shocks can impact positively upon the wage-rate as well as the level of profits of the firm. Note that this stands in some contrast to the purely competitive case according to which labour supply to the firm is perfectly elastic at the going wage. Demand shocks are only met with increases in employment rather than the wage rate such that no positive relation between pay levels and profits would be anticipated. Nevertheless, the point made by Hildreth and Oswald (1994) is that more convincing evidence of rent-sharing requires more than a short-run relation between wages and ability to pay. This becomes especially important given that if the elasticity of labour demand is less than one, then the same model predicts a positive relation between wage levels and profit-per-worker (Blanchflower and Oswald, 1994). In our own case of considering employees *and* executives, doing so in the context of a three-way asymmetric bargain between the owners of the firm, its employees and most senior executive would imply the existence of prolonged, or lagged effects between wages and total profits in the case of executive pay. For this reason, and following Hildreth and Oswald (1994), the empirical work places an emphasis upon observing significant lagged effects from measures of ability-to-pay to levels of pay in order to provide support for the rent-sharing model's predictions[1] .

Proposition 3 and the agency approach warrants further discussion. There are problems with this formulation, not least the fact that under agency models, difficulties are to be encountered in deriving general properties of the optimal piece rate and its sensitivity to certain assumptions (Grossman and Hart, 1983) such as regarding the form of the agent's utility function. Moreover, in the case of multi-task agency where the agent performs more than one task which may be observable to different degrees and represent substitutes for one another in the agent's effort function, it becomes less desirable to make pay contingent upon performance since this detracts from other aspects of effort (Holmstrom and Milgrom, 1991).

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[1] see Hildreth and Oswald (1994) for a clear derivation of propositions 1 and 2. On proposition 3 see Rosen (1992).

Despite these important points, casual inspection of company annual reports indicates that firms are concerned with the issue of motivation of executives and consider rewarding executives for good performance as an important means to achieve this. This is arguably the strongest rationale for estimating the type of models which have appeared in the empirical literature on executive pay.

In deriving, the view that pay will depend upon performance, the natural next step is to address the issue of an appropriate measure for performance. It has been argued that the agency perspective is best encapsulated by shareholder return on the grounds that this is the variable which most accurately reflects the welfare of the principal (see Conyon *et al* 1995). Generally, it appears however, that the correspondence between agency theory and the executive pay estimating equations is not strong. It is perhaps not surprising therefore that studies of executive pay have tended to cite the agency approach at a heuristic level in providing a basis to the empirical work undertaken. Given the established nature of this literature, this only serves to heighten the importance of attempting to test between competing models. In addition, a strong case can be made for arguing that the appropriate interpretation of the "agency" approach results we provide is in terms of testing the extant empirical literature rather than the theoretical approach on which it is only loosely based. A priori, a strong case can also be made for arguing that this approach will have greater relevance at the executive vis a vis the employee level. The specialisation of knowledge and problems of monitoring are presumably greater at the executive level while issues of joint inputs are less severe.

3 Estimation and Results

In this section we attempt to confront the propositions derived from the competing approaches with data on an unbalanced panel of 375 manufacturing companies with a minimum of nine continuous observations over the period 1984-94. In so doing, we estimate general company-level pay equations for employees and executives.

Prior to so doing, it may first be necessary to justify the use of unrestricted estimating equations in order to confront static economic theory. This point is noted by Hildreth and Oswald (1994) who argue that it represents an appropriate response given the presence of sluggish adjustment in wages which may also vary across firms. Clearly, the use of lags on regressors may also help attenuate issues of simultaneity. The issue of simultaneity is an empirical one, emphasised by both Abowd and Lemieux (1993) and Hildreth and Oswald (1994), which can be addressed both by the use lagged profitability effects as well as the implementation of an instrumental variables estimator.

Data and Estimation Method

Issues of simultaneity are therefore addressed via the use of an instrumental variable estimator. More specifically, we employ the Generalised Method of Moments estimator of Arellano and Bond (1988, 1991). This GMM estimator represents an efficient extension of the instrumental variable estimator of Anderson and Hsaio (1982) where the source of the efficiency gains lies in the addition of further instruments for the endogenous variable(s) as one proceeds through the panel (i.e. as 't' increases). A number of regressor variables suggest themselves as being potentially endogenous in our estimating equations. We treat all company-level regressors as endogenous.

If the estimating equation is first differenced, Arellano and Bond (1991) show that valid instruments for the endogenous variable can be the levels of the endogenous variable dated t-2 and earlier. The validity of the estimation method depends crucially upon the absence of serial correlation in the levels model. This implies the absence of second-order serial correlation in the estimated equation for which Arellano and Bond (1991) provide a test statistic (reported as m_2 below), in addition to the need to report conventional tests for instrument validity.

The data used for the present study comes from an unbalanced panel of 375 manufacturing companies with a minimum of nine continuous observations over the period 1984-94. The dataset was obtained from the Datastream database of company accounts and includes detailed financial information on this set of companies. Inspection of the summary statistics contained in Table A.2 reveals a number of familiar patterns. The average employee wage increases from £ 10 682 in 1984 to £13 382 in 1994 (in 1990 prices). Base and bonus pay of the highest paid director rises considerably from approximately £ 87 000 in 1984 to almost £ 200 000 in 1994. This mirrors closely the patterns described by Conyon *et al,* (1995). The mean value of profit per worker is £ 5330 for the 1984-94 period as a whole, increasing upto 1990. The profit per worker series experiences a recovery in 1993-94 following the recession of the late 1980s and early 1990s.

Our estimation method resembles that of the previous studies of employee- and executive studies of pay determination based on firm-level data. This is appropriate since our focus is upon comparing these sets of approaches in order to gain insight into which, if any, is relatively more consistent with the data.

Following on from our earlier discussion, the empirical model which corresponds to that of the case of bargaining is estimated as follows :

$$w_{it} = f_i + \theta w_{it-1} + \sum_{j=0}^{k} \beta_j \left(\tfrac{\pi}{N}\right)_{it-j} + \gamma_t + u_{it} \qquad (1)$$

where w_{it} denotes the log of average employee pay or highest paid director salary and bonus pay at firm 'i' in year 't'; (π / N) represents profit per employee, f_i and γ_t refer to firm- and time- specific effects respectively with 'u' as an error term.

According to the competitive model subject to frictions, demand shocks may impact positively upon the level of pay as well as the volume of total profits such that total profits are included in the regression model.

$$w_{it} = f_i + \lambda w_{it-1} + \sum_{j=0}^{k} \delta_j \pi_{it-j} + \gamma_t + v_{it} \qquad (2)$$

The third type of model we consider, which is moulded by the agency-type considerations appearing in the previous executive pay literature has the following structure :

$$w_{it} = f_i + \varphi\, w_{it-1} + \sum_{j=0}^{k} \tau_j\, sales_{it-j} + \sum_{j=0}^{k} \alpha_j\, p_{it-j} + \gamma_t + e_{it} \qquad (3)$$

in which '$sales_{it}$' represents the log of company sales and 'p_{it}' shareholder return in company 'i', year 't'. Again, although the theory provides little rationale for the company sales term, its inclusion reflects our concern with considering the approach as adopted in earlier studies of executive pay.

Estimation Results

Our results are quite striking both in their ability to favour individual models and in the observed difference between employee and executive pay.

At the employee level, the pattern of results reveals a strong degree of correspondence with the bargaining model. There is evidence of a long-run relation between profit-per worker and wages at lags of upto t-5. The long-run elasticity of the wage - profit per worker relation is estimated at 0.094. This is somewhat higher than a number of earlier estimates, comparing to the estimates of 0.01 by Denny and Machin (1991), 0.02 by Hildreth and Oswald (1994). An estimate for the United States of 0.08 is obtained by Blanchflower *et al* (1996). However, Van Reenen (1996) for the UK and Abowd and Lemieux (1993) for Canada, both of which employ external instruments for the rents variable, obtain elasticity estimates of 0.23 and 0.26 respectively.

Concerns over the use of wage bill data in order to derive a pay variable which is then regressed against a term normalised on the number of employees, may be addressed by the addition of an employment variable into the estimating equation. In addition this may also help further safeguard against the possibility that the observed relation reflects a short-term correlation induced by demand shocks. The resulting estimates are essentially equivalent to those reported in Table 1 with the lag at t-5 for instance, retaining its significance.

A number of comments are perhaps worthy of note. First, although statistically significant our estimated elasticity is not especially well-determined such that it is difficult to impart a strong degree of confidence into this precise estimate. Second, an elasticity of 0.09 might still appear low in terms of responsiveness of wages to profit per worker. Oswald (1995) responds to this suggestion by arguing that profits represent a volatile series such that apparently small elasticities are both more realistic and continue to imply significant variation in wages. Whilst this is an important point to make, its relevance may be exaggerated. Despite being more volatile than several economic series, there is a significant degree of persistence to profits. Thus a simple autoregressive model of profits per worker, including firm-specific and time effects results in a coefficient on the lagged dependent variable (which is instrumented) of 0.55.

In reviewing empirical studies of rent-sharing, Oswald (1995) cites Lester's range of wages for reasons of rent-sharing[2] as a summary statistic of rent-sharing in the determination of wages. Our own estimate emerges as 46 %. Further caution however is required in interpreting this figure. The regression estimates describe time-series effects in the data for our set of companies whereas the dispersion in the variable, measured by its standard deviation, largely reflects inter-company variation in profits. As noted above, for individual companies there is a significant degree of persistence to profits. Thus the employed standard deviation for the summary statistic is likely to over-estimate the likely variation in profits for individual companies.

Turning to the estimates for the modified competitive model, these are in marked contrast to that predicted by the theory. There is no evidence of a short-run wage - total profits correlation but instead this relation takes on greater significance at deeper lags of the profit variable. Thus, in contrast to the predictions of the model, there is a statistically significant long-run elasticity of wages and profits of 0.019. This continues to suggest that ability to pay is an influence upon wage levels. Relatedly, the lack of correspondence with the modified competitive model also helps

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2 This measures the effect on wages of a four standard deviation change in profits such that ,

$L = 4\eta_{\pi W}\left(\frac{\sigma_{\pi}}{\bar{\pi}}\right)$ where η represents the wage -profit per worker elasticity, σ the standard deviation of the profit variable and $\bar{\pi}$ its mean.

indicate that the observed relation between employee pay and profit-per-worker represents a causal one.

Table 3 presents results for what we term an agency model. This essentially represents the type of models estimated in studies of executive pay (see Conyon *et al* 1995). Although a case can be made for arguing that the same incentive problems that arise at the executive level also arise at the employee level, a priori we consider this a relatively unconvincing rationale for suggesting a relation between pay and shareholder return at the employee level. In this respect it is perhaps encouraging that the results do not indicate a significant relation between employee pay and shareholder return.

We conclude from this section that the pattern of results at the employee level strongly favour the bargaining model.

An advantage in the analysis of executive pay is that in considering the pay of a single individual it avoids some of the issues which arise in the use of wage bill data to construct the pay variable. We begin with estimates of the bargaining model. The results offer less strong support for the presence of bargaining at the executive-level, vis a vis the employee level, across our full sample of companies. The profit terms are positively signed but tend to fall short of statistical significance at conventional levels. Although the profit-per-worker term dated t-4 is close to significance, the long-run elasticity is insignificant.

In the case of executive pay, the modified competitive model receives relatively strong support. The model estimates contained in Table 2 indicate a positive contemporaneous relation between pay and profits which tails off over time. There is no significant long-run effect from profits to pay such that the observed pattern appears to closely mirror that implied by the theory.

In Table 3, we repeat the analysis of executive pay in terms of the agency model. Although the theory only serves to indicate a relation between the performance term and pay, we also include sales terms in order to maintain comparability with previous studies of executive pay (e.g. Gregg *et al,* 1993). The results indicate a long-run effect from shareholder return to pay, suggesting support for the main prediction of the theory. A further point worthy of note is that we obtain a higher estimated elasticity of pay with respect to shareholder return than that present in several previous studies. This largely results from a combination of the estimation of a less restrictive lag structure on the shareholder return variable and the use of an instrumental variables method, rather than least squares. The long-run elasticity is estimated at 0.049. Adding further lags on the sales term beyond t-2 (which are jointly insignificant) does not alter the results presented, in terms of this long-run elasticity.

With regard to the results at the executive level, it might be noted that much of the public concern expressed in terms of executive pay awards has been with respect to those awarded in firms which dominate their product markets. As an attempt to consider whether the previous set of results for the bargaining model might vary according to the degree to which the firm dominates its product market, we re-estimated the models, partitioning the firms into those with high versus low market shares (according to the median value). However, the results failed to reveal any notable differences across the two sets of firms. Clearly, this may raise as many questions about an appropriate index of market power and the suitability of market share for this purpose.

An alternative and perhaps more satisfactory method of considering variations in the magnitude of the profitability effects is to allow them to be a function of the volume of rents. Moreover, this is of further importance since, as Abowd and Lemieux (1993) show, if this is the case and the degree of relative bargaining strength is a function the volume of rents available, then the failure to allow for this will generate inconsistent estimates of the mean bargaining power parameter. Thus, if the bargaining effect, β, may be represented by the expression :

$$\beta_i = \bar{\beta} + \tilde{\beta}\left(\frac{\pi}{N} - \overline{\left(\frac{\pi}{N}\right)}\right)$$

in which $\overline{\left(\frac{\pi}{N}\right)}$ represents mean profit-per-worker and $\bar{\beta}$ is the mean value of the profit-per-worker effect, then substitution of this expression into our general bargaining model pay equation (Equation 1) generates :

$$w_{it} = f_i + \theta w_{it-1} + \sum_{j=0}^{k} \overline{\beta_j} \left(\tfrac{\pi}{N}\right)_{it-j} + \sum_{j=0}^{k} \widetilde{\beta}_j \left(\tfrac{\pi}{N}\right)_{it-j} \left(\left(\tfrac{\pi}{N}\right)_{it-j} - \left(\tfrac{\pi}{N}\right)_{t-j}\right) + \gamma_t + \left\{ \mu_{it} \sum_{j=0}^{k} \left(\tfrac{\pi}{N}\right)_{it-j} + u_{it} \right\} \qquad (4)$$

Equation 4 implies that estimates of the profit-per-worker effects upon levels of pay, based solely on the inclusion of the linear terms, will generate inconsistent estimates. Provided, cov(μ_{it} π / N_{it}) = 0, then the addition of the quadratic terms will allow consistent estimates of the mean profit per worker effects across the set of companies. If it is the case that cov(μ_{it} π / N_{it}) $\neq$ 0, then IV estimates are necessary for consistency. The $\widetilde{\beta}$ effects will also provide evidence regarding whether the profit per worker effects are increasing ($\widetilde{\beta} > 0$) or decreasing in the volume of rents available.

In the light of this, in Table 4 we re-estimate our bargaining model allowing the bargaining parameters to vary according to the volume of rents in this way. It is clear from the results in Table 4 that no clear pattern emerges at either the employee or executive level regarding the variation in profitability effects upon pay levels according to the level of rents. We may also note that the estimates of the mean effects are affected to only a minor degree by the inclusion of these additional terms.

Non-Nested Tests

Given that each model does not represent a special case of its rivals, the use of non-nested tests may further assist in the aim of testing between the competing approaches to the determination of employee and executive pay. Thus as a further means of attempting to discriminate between the competing models, we now turn to the results of employing non-nested tests. Table 6 presents the results of J-Tests (Davidson and MacKinnon, 1981) between the models outlined previously.

At the employee level, the results are consistent in favouring the bargaining model. The bargaining model is able to reject the null model of the competitive and agency models whilst is also unable to be rejected by either of these models when it represents the null model. The consideration of the bargaining model with heterogeneous profitability effects offers a similar pattern of results, although in this case the agency model as alternative is also able to reject the bargaining null model. It should be recalled that rather than expressing which model is relatively more consistent with the data, non-nested tests are to be interpreted as a form of specification test in a more general sense (Davidson and MacKinnon, 1993, pp. 381-388).

At the executive model, the results appear to favour the modified competitive model. Both bargaining and agency models are able to be rejected by the competitive model whilst these models are in turn unable to reject the competitive model at conventional significance levels. The additional bargaining model which allows for heterogeneous bargaining effects according to the volume of rents offers the same consistency and form of results.

This lack of ambiguity from the non-nested tests is very encouraging. We may note for instance that Hildreth and Oswald (1994) found that, for their company panel dataset, the non-nested tests were unable to consistently favour one individual model.

4 Conclusions

The Chapter has considered models of wage determination in firm level data, considering both employee and executive levels of the firm. For the first time, the study attempts to consider both employee and executive pay determination in a comparable fashion and in so doing allows us to consider whether the forces of wage determination differ between these levels of the firm.

At the employee level, the results obtained strongly favoured the bargaining model. As such the results had much in common with those presented in Hildreth and Oswald (1994) with long-run effects from profit-per-worker to wages being observed. As emphasised by Hildreth and Oswald (1994), evidence of bargaining requires such prolonged effects from profit-per-worker in addition to a contemporaneous relation. The long-run elasticity of pay with respect to profit per worker was estimated at 0.094 and was statistically significant. The pattern of results also ran counter to those anticipated on the basis of the competitive model subject to frictions and agency models. Despite the traditional problems of lacking power and consistency, these points were also borne out by the results of non-nested tests between the competing sets of models.

At the executive level, a different pattern of results emerged. The existence of bargaining was less clear. Rather, our estimation results on the basis of the same 375 manufacturing companies, led us to favour the competitive model subject to supply frictions.

An interpretation in line with the modified competitive model would be consistent with the view that partly responsible for accounting for the high levels of pay awards to executives in the recent period may be a catch-up in response to the decline in real pay which took place over the 1970s (see Main, 1992) which may partly have resulted from the imposition of incomes policies over this period. At the same time, the results also found evidence of significant and persistent effects from shareholder return to executive pay. This is encouraging in terms of the established literature on executive pay - although our results indicated the desirability to include relatively long lags on the shareholder return variable. The elasticity of pay with respect to shareholder return, evaluated at the mean, was estimated at 0.049. It was also suggested that a suitable area for future research would be to consider in greater detail the circumstances under which bargaining by executives as well as by employees may take on greater significance.

Table 1 : Bargaining Model Estimates, 1984-94		
	Employees Dependent Variable : $\log(\text{wage})_{it}$	**Executives** Dependent Variable : $\log(\text{highest director salary})_{it}$
constant	-0.0140 (0.0071)	-0.0133 (0.0201)
$\log(\text{wage})_{i\,t-1}$	0.4668 (0.1376)	-
$\log(\text{highest director salary})_{it-1}$	-	0.3526 (0.1937)
$(\pi / N)_{i\,t}$	0.0139 (0.0058)	0.0130 (0.0089)
$(\pi / N)_{i\,t-1}$	-0.0016 (0.0037)	0.0049 (0.0082)
$(\pi / N)_{i\,t-2}$	0.0057 (0.0018)	0.0010 (0.0078)
$(\pi / N)_{i\,t-3}$	-0.0026 (0.0022)	0.0027 (0.0037)
$(\pi / N)_{i\,t-4}$	0.0047 (0.0024)	0.0078 (0.0046)
$(\pi / N)_{i\,t-5}$	0.0035 (0.0016)	0.0026 (0.0075)
time dummies	yes	yes
m_2	-0.795	-0.284
Sargan	36.87 (42)	33.34 (23)
Wald(time dummies)	71.13 (5)	60.92 (5)
companies	375	375
observations	1635	1635

Notes

1. All models are estimated in first-differences ; one-step estimator heteroskedastic- consistent standard errors in parentheses.;
2. Wald(time dummies) is a Wald test of the joint significance of the time dummies
3. Sargan is a Sargan test of instrument validity, distributed $\chi^2(df)$
4. $m_2 \sim_a N(0,1)$ and is a test of second-order serial correlation (Arellano and Bond, 1991).
5. Instruments used are lags of t-2 and earlier.
   Variables treated as endogenous are $\log(W)_{it-1}$, $\log(hds)_{it-1}$, $(\pi / N)_{it-j}$.

Table 2 : Modified Competitive Model Estimates, 1984-94

	Employees Dependent Variable : $\log(\text{wage})_{it}$	**Executives** Dependent Variable : $\log(\text{highest director salary})_{it}$
constant	-0.0138 (0.0051)	-0.0108 (0.0142)
$\log(\text{wage})_{i\,t-1}$	0.2370 (0.1392)	-
$\log(\text{highest director salary})_{it-1}$	-	0.3476 (0.1164)
$\pi_{i\,t}$	0.0253 (0.0859)	0.4248 (0.2057)
$\pi_{i\,t-1}$	0.0260 (0.0572)	-0.2771 (0.2294)
$\pi_{i\,t-2}$	0.0142 (0.0581)	0.0403 (0.2220)
$\pi_{i\,t-3}$	0.0681 (0.0608)	-0.0368 (0.1598)
$\pi_{i\,t-4}$	-0.0746 (0.0884)	0.1612 (0.1702)
$\pi_{i\,t-5}$	0.2532 (0.1082)	0.1146 (0.2125)
time dummies	yes	yes
m_2	-0.796	-0.163
Sargan	43.85 (38)	36.26 (38)
Wald(time dummies)	33.72 (5)	78.09 (5)
companies	375	375
observations	1635	1635

Notes

1. All models are estimated in first-differences ; one-step estimator heteroskedastic- consistent standard errors in parentheses.;
2. Wald(time dummies) is a Wald test of the joint significance of the time dummies
3. Sargan is a Sargan test of instrument validity, distributed $\chi^2(\text{df})$
4. $m_2 \sim_a N(0,1)$ and is a test of second-order serial correlation (Arellano and Bond, 1991).
5. Instruments used are lags of t-2 and earlier.
   Variables treated as endogenous are $\log(W)_{it-1}$, $\log(hds)_{it-1}$, $\pi_{\,it-j}$.

Table 3 : Agency Model Estimates, 1984-94		
	Employees Dependent Variable : $\log(\text{wage})_{it}$	**Executives** Dependent Variable : $\log(\text{highest director salary})_{it}$
constant	-0.0147 (0.0097)	0.0527 (0.0237)
$\log(\text{wage})_{i\,t-1}$	0.4878 (0.1429)	-
$\log(\text{highest director salary})_{it-1}$	-	0.4151 (0.0954)
$\text{sales}_{i\,t}$	0.1326 (0.0625)	0.2842 (0.1400)
$\text{sales}_{i\,t-1}$	-0.0090 (0.0608)	-0.3418 (0.1667)
$\text{shareholder return}_{it}$	-0.0189 (0.0246)	0.1045 (0.0546)
$\text{shareholder return}_{it-1}$	-0.0112 (0.0212)	-0.0296 (0.0497)
$\text{shareholder return}_{it-2}$	0.0024 (0.0149)	0.0807 (0.0333)
$\text{shareholder return}_{it-3}$	0.0031 (0.0133)	0.0660 (0.0284)
$\text{shareholder return}_{it-4}$	0.0026 (0.0106)	0.0721 (0.0284)
$\text{shareholder return}_{it-5}$	0.0088 (0.0127)	0.0597 (0.0311)
time dummies	yes	yes
m_2	-1.048	0.530
Sargan	48.44 (41)	34.96 (41)
Wald(time dummies)	22.25 (5)	36.03 (5)
companies	375	375
observations	1635	1635

Notes :

1. All models are estimated in first-differences ; one-step estimator heteroskedastic- consistent standard errors in parentheses.;
2. Wald(time dummies) is a Wald test of the joint significance of the time dummies
3. Sargan is a Sargan test of instrument validity, distributed χ^2(df)
4. $m_2 \sim_a N(0,1)$ and is a test of second-order serial correlation (Arellano and Bond, 1991).
5. Instruments used are lags of t-2 and earlier.
   Variables treated as endogenous are $\log(W)_{it-1}$, $\log(hds)_{it-1}$, sales_{it-j}, and shr_{it-j} .

Table 4 : Bargaining Model With Heterogeneity Terms, 1984-94

	Employees Dependent Variable : $\log(\text{wage})_{it}$	**Executives** Dependent Variable : $\log(\text{highest director salary})_{it}$
constant	-0.0129 (0.0064)	-0.00656 (0.0151)
$\log(\text{wage})_{i\,t-1}$	0.3802 (0.1202)	
$\log(\text{highest director salary})_{it-1}$		0.3302 (0.1268)
$(\pi / N)_{i\,t}$	0.0121 (0.0035)	0.0167 (0.0071)
$(\pi / N)_{i\,t-1}$	-0.0040 (0.0033)	-0.0127 (0.0059)
$(\pi / N)_{i\,t-2}$	0.0050 (0.0021)	0.0048 (0.0036)
$(\pi / N)_{i\,t-3}$	0.0016 (.0018)	-0.0015 (0.0035)
$(\pi / N)_{i\,t-4}$	0.0012 (0.0018)	0.0077 (0.0042)
$(\pi / N)_{i\,t-5}$	0.0042 (0.0021)	-0.0017 (0.0037)
$\frac{\pi}{N}_{it}\left(\frac{\pi}{N}_{it} - \left(\frac{\pi}{N}_{t}\right)\right)$ *	0.0001 (0.0033)	−0.0106 (0.0066)
$\frac{\pi}{N}_{it-1}\left(\frac{\pi}{N}_{it-1} - \left(\frac{\pi}{N}_{t-1}\right)\right)$ *	−0.0048 (0.0031)	0.0112 (0.0063)
$\frac{\pi}{N}_{it-2}\left(\frac{\pi}{N}_{it-2} - \left(\frac{\pi}{N}_{t-2}\right)\right)$ *	0.0076 (0.0045)	−0.0005 (0.0090)
$\frac{\pi}{N}_{it-3}\left(\frac{\pi}{N}_{it-3} - \left(\frac{\pi}{N}_{t-3}\right)\right)$ *	−0.0182 (0.0053)	0.0059 (0.0083)
$\frac{\pi}{N}_{it-4}\left(\frac{\pi}{N}_{it-4} - \left(\frac{\pi}{N}_{t-4}\right)\right)$ *	0.0108 (0.0047)	−0.0169 (0.0089)
$\frac{\pi}{N}_{it-5}\left(\frac{\pi}{N}_{it-5} - \left(\frac{\pi}{N}_{t-5}\right)\right)$ *	−0.0074 (0.0059)	0.0060 (0.0082)
time dummies	yes	yes
m_2	-0.656	-0.069
Sargan	38.08 (37)	53.43 (47)
Wald(time dummies)	55.28 (5)	64.33 (5)
companies	375	375
observations	1635	1635

Notes

as for Table 1 except

1. variables treated as endogenous are $\log(W)_{it-1}$, $\log(hds)_{it-1}$, $(\pi/N)_{it-j}$
   $\left(\frac{\pi}{N}\right)_{it-j}\left(\frac{\pi}{N}_{it-j} - \left(\frac{\pi}{N}\right)_{t-j}\right.$.
2. * denotes coefficient and standard error multiplied by 100.

Table 5 : Long-run Elasticities
(t-statistic)

	Employees	Executives
Bargaining [π / N]	0.0938 (2.0819)	0.0638 (0.9516)
Modified Competitive [π]	0.0189 (2.6482)	0.0189 (1.1009)
Agency [shareholder return]	0.0101 (0.8607)	0.0494 (2.3144)
Heterogeneous Bargaining [π / N]	0.0981 (2.1158)	0.1210 (1.1902)

Notes :

1. Long-run elasticities, evaluated at the mean, obtained from a supplementary regression with the respective explanatory variable, 'y', dated t to t-4 in the form Δy; the coefficient on y_{t-5} represents the long-run effect of 'y' upon the wage level.

Table 6 : Non-Nested Tests

		J-Statistic	
Null Model	Alternative Model	Employees	Executives
Competitive	Bargaining	3.170**	0.373
Bargaining	Competitive	1.243	3.047**
Agency	Bargaining	2.051**	0.312
Agency	Competitive	2.413**	2.853**
Bargaining	Agency	0.407	0.307
Competitive	Agency	0.760	1.148
Competitive	Heterogeneous Bargaining	2.933**	1.695
Agency	Heterogeneous Bargaining	1.343	0.289
Heterogeneous Bargaining	Competitive	0.948	2.498**
Heterogeneous Bargaining	Agency	2.466**	0.645

Notes

1. J-Tests (Davidson and MacKinnon, 1981) where J-statistic is given by the 't'-statistic on regressions including fitted values from alternative model ; ** denotes significance at 1% level.

Data Appendix

Table A.1

The panel is unbalanced with the following number of records per company,

records per company	9	10	11
number of companies	33	174	168

Table A.2 : Summary Statistics

Means (standard deviation)						
	employee wage ($£_{1990}$)	highest director salary ($£_{1990}$)	(π / N) ($£_{1990}$ 000)	π ($£_{1990}$ Bn)	shareholder return	company sales ($£_{1990}$ 000)
1984	10681.85	87167.24	4.25	0.03553	0.3162	505090.03
	(2978.48)	(76415.13)	(4.71)	(0.1389)	(0.3965)	(1757917.3)
1985	10969.19	92939.93	4..56	0.0313	0.2698	450321.91
	(3072.48)	(82901.05)	(4.91)	(0.1230)	(0.4179)	(1621823.70)
1986	11530.75	102876.09	5.07	0.0418	0.4995	475445.04
	(3250.89)	(80621.24)	(5.22)	(0.1837)	(0.5348)	(1625466.00)
1987	12159.55	118752.41	5.85	0.0486	0.2953	511956.61
	(3335.13)	(87058.85)	(5.98)	(0.2077)	(0.4508)	(1644955.60)
1988	12429.55	133707.37	6.54	0.0562	0.1473	543854.19
	(3441.41)	(100675.54)	(6.51)	(0.2189)	(0.2951)	(1660127.60)
1989	12610.67	145595.15	6.71	0.0601	0.1052	592997.97
	3453.56)	(123695.25)	(7.35)	(0.2296)	(0.3581)	(1873842.80)
1990	12472.24	145530.30	6.09	0.0558	-0.1619	568913.80
	(3402.01)	(119084.11)	(7.43)	(0.2230)	(0.2724)	(1790322.05)
1991	12583.96	150431.04	4.90	0.0494	0.2063	543327.10
	(3418.85)	(150289.82)	(7.35)	(0.2218)	(0.4005)	(1728027.21)
1992	13037.64	151948.11	4.28	0.0455	0.1357	532462.80
	(3610.70)	(115288.25)	(6.88)	(0.2133)	(0.4115)	(1701805.40)
1993	13501.16	177822.69	4.54	0.0462	0.4229	533071.84
	(4012.26)	(155544.28)	(6.69)	(0.2138)	(0.5663)	(1757312.70)
1994	13381.92	197687.79	5.91	0.0553	0.0342	502631.69
	(4321.22)	(185751.49)	(8.43)	(0.2392)	(0.3148)	(1296405.11)
1984-94	12285.67	134981.37	5.33	0.0477	0.2116	525019.49
	(3566.53)	(121771.81)	(6.58)	(0.2036)	(0.4505)	(1696572.41)

Table A.3 : Data Definitions

Variable
Profits : Datastream Item 137. This is defined as total profits from normal activities of the company after depreciation and operating provisions (exceptional items).
Employee Wage : We take the nominal employee wage to be given by : w = total employee remuneration / total number of employees where total wage bill is Datastream Item 215 total number of employees is Datastream Item 219 To obtain a real wage rate we deflate 'w' by the retail price index.
Highest-paid Director salary Source : Datastream Item 244 deflated by the retail price index. This includes salary, bonus and benefits but excludes share options and equity.
Shareholder return Source : Datastream. Total shareholder return is defined as the change in the return index. The return index represents the total value of holding a notional stock. The holding is deemed to return a daily dividend, which is used to purchase new units of the stock at the current price. The gross dividend is used.
Company Sales Source : Datastream Item 104 (total company sales) deflated by retail price index.

Chapter 6

Efficiency Wages and Company Performance : Employees and Executives

Abstract : Models of wage determination are examined following the analysis of Konings and Walsh (1994). The analysis is applied to the executive as well as employee levels of the firm using a panel of over 500 UK firms.

Greater support for efficiency wage theory is found at the executive relative to the employee level. Bargaining takes on greater significance in firms with higher market share at both levels of the firm. This is interpreted as evidence of rent-capture in the determination of both employee and executive pay and may be contrasted in particular to the extant literature on executive pay.

1 Introduction

Economic analyses of issues relevant to the efficient functioning of labour and product markets have come to place an emphasis upon the impact of bargaining relationships within the firm - with these frequently taking the form of some type of rent-sharing[1] . At the same time, rent-sharing continues to represent a central issue in the analysis of wage determination (e.g. Blanchflower *et al.*, 1996). Given that rent-sharing may be predicted by alternative theoretical models, in particular bargaining and efficiency wage models, a further concern is to identify the source of rent-sharing (Konings and Walsh, 1994). Where this is consistent with one theoretical model, this may in turn help to explain the marked real wage growth by historical standards experienced in the UK economy over the 1980s. Ideally, an analysis of the forces of wage determination over this period might also offer some insight into potential sources of the unprecedented rise in earnings *inequality*.

It is against this background of rising pay inequality that recent concern over pay awards to executives has been expressed. The suspicion has been that executives are not, for reasons of bargaining strength, subject to the same pressures of wage restraint as applies at lower levels of the firm. Alternatively, the observed pattern of awards and widening pay inequality may reflect market forces and the market placing a premium upon skills, including those of executives.

Do the forces of wage determination differ between levels of the firm ? In view of the changes which have taken place in UK labour markets over the past decade, this appears a central question to ask - but one which is absent from previous studies of pay determination. In the present Chapter, we explicitly consider how the forces of wage determination apply at, and differ between, employee and executive levels. More specifically, we test for the presence of bargaining versus efficiency wage payments. An extension of the analysis, based on that by Konings and Walsh (1994), allows us to assess the degree of rent capture in pay determination. We maintain that this allows us to focus upon the twin economic concerns of efficiency and equity that strike at the core of recent changes in the UK labour market.

The rest of the Chapter is organised as follows. Section 2 provides the discussion of efficiency wages and bargaining, illustrating our main hypotheses regarding the implied

[1] Such studies include recent analyses of productivity growth (e.g. Nickell, 1996; Nickell *et al.*, 1992).

relation between wage premia and product market performance. The empirical model is provided and discussed in Section 3. This is followed by estimation and results in Section 4. Concluding remarks are offered in Section 5.

2 Theoretical Considerations

The analysis is concerned with examining sources of variation in wages between firms and observing whether this should be positively or negatively related to the product market performance of firms. Three alternative and general models of wage determination are considered : a bargaining, efficiency wage, and competitive model.

A Bargaining

Bargaining is fundamental to issues of wage determination. In terms of the changes which have occurred over the 1980s, the impact of changes in the legislative environment and decline in collective bargaining have provided a context for examining their impact upon the union - non-union wage differential (Stewart, 1991, 1995) and the dispersion of pay (Gregg and Machin, 1994; Gosling and Machin, 1995).

Nevertheless, despite this significance assigned to the role of bargaining, its importance has not been recognised in studies of executive pay determination which have focused exclusively on the provision of incentives (e.g. Conyon *et al.*, 1995). One may suspect that executives are in an especially strong bargaining position within the firm with the quit threat for instance, being an especially strong bargaining tool vis a vis that of employees.

Hence in this section we outline the familiar bargaining model which provides a basis to the empirical work in the comparison between bargaining, efficiency wage and competitive models.

We assume that employees - or executives - are risk neutral and seek to maximise a utility function which is given by the wage rate [2], $U(W) = W$. Bargaining occurs over the wage with employment-setting being retained by the employer. We employ the conventional

2 Blanchflower and Oswald (1994) show that the central result carries through where this utility function is of a more general form. We also assume zero unemployment risk.

asymmetric Nash bargaining solution for this model. The generalised Nash product may be specified as :

$$\Omega \;=\; (U-\overline{U})^{\beta}\,(\pi-\overline{\pi})^{1-\beta} \tag{1}$$

where we set the threat points ($\overline{U}$, $\overline{\pi}$) as ($\overline{W}$, 0) with β representing the bargaining strength of the union (or executive in the executive-firm bargain). Hence,

$$\Omega \;=\; (W-\overline{W})^{\beta}\,\pi^{1-\beta} \tag{2}$$

Taking logs and differentiating,

$$\frac{\partial \log \Omega}{\partial W} \;=\; \frac{\beta}{W-\overline{W}} + \frac{(1-\beta)}{\pi}\frac{\partial \pi}{\partial W} \;=\; 0$$

since $\pi_W = -L$, we have,

$$W \;=\; \overline{W} + \left(\frac{\beta}{1-\beta}\right)\frac{\pi}{L} \tag{3}$$

This is derived by Carruth and Oswald (1989) and has been the basis to several empirical wage equations with profitability entered as a regressor (e.g. Denny and Machin, 1991; Hildreth and Oswald, 1994). In contrast, Konings and Walsh (1994) choose to work in the context of a performance equation in which variation in wages occurs resulting from variations in the relative bargaining strength of employees, noting the following comparative static properties :

$$W_{\beta} \;>\; 0 \qquad\qquad \pi_{\beta} \;<\; 0$$

In this way the model implies that paying a higher wage for reasons of increasing bargaining strength leads to a negative spillover to profitability. Compared to our subsequent modelling of efficiency wages, this provides the basis to the Konings and Walsh (1994) approach of testing between efficiency wage and bargaining outcomes.

B Efficiency Wages

Efficiency wages have taken on a prominent role in the economics of unemployment and have widely been cited as an attractive model of explaining wage rigidity and wage differentials. In our empirical model presented below, we acknowledge the potential role for efficiency wage considerations applying to the case of executives - and contrast this to previous studies of executive pay. Difficulties of monitoring might be especially acute in the case of executives. Previous studies have taken this as implying the relevance of agency theory considerations (e.g. Jensen and Murphy, 1990; Conyon and Leech, 1994). However, we wish to emphasise the generality of the efficiency wage approach in that in addition to the issue of motivating executives - which corresponds to the moral hazard agency case - the analysis places similar emphasis upon the recruitment and retention of high quality labour (adverse selection models). However, in so doing efficiency wage theory would appear to indicate that the link between pay and company performance - the issue upon which previous studies of executive pay have chosen to focus - may not be as significant an issue as these studies have attempted to argue . Efficiency wage theory argues that the mere process of offering a wage above the market clearing level offers productivity gains. This wage premium need not be set contingent upon company performance. Furthermore, a strong case can be made for maintaining that efficiency wage theory provides a more likely basis for empirical analysis than do formal principal-agent models.

In the efficiency wage model, price is a function of total industry output which consists of that of, say, two firms,

$$P = P(X+Y)$$

with,

$$P'(.)<0 \qquad P''(.)=0 \qquad (4)$$

Output of Firm 1 is specified as :

$$X = F(eL) \qquad (5)$$

The effort function e(.) is given by :

$$e(W-A) = 1 + \gamma(W-A)^{\alpha} \qquad (6)$$

$$e'(.) > 0 \,; \qquad e''(.) < 0$$

in which γ varies across firms and reflects the degree to which employment conditions imply effort depends upon the wage offer and hence facilitate efficiency wage payments

The profitability of Firm 1 is then given as :

$$\pi \;=\; P(X+Y)X - WL \qquad (7)$$

Deriving the first-order conditions :

$$\pi \;=\; P(F(eL)+Y)F(eL) - WL \qquad (7b)$$

$$\pi_L \;=\; P_F\, F'(.)e\,F(eL) - W + P(.)F'(.)e$$

$$=\; PF'\left\{ \frac{P_F}{P} e\,F(.) + e \right\} - W \;=\; 0$$

$$\pi_L \;=\; e\,PF'(.)\left\{ 1 + \frac{1}{\eta} \right\} - W \;=\; 0$$

since, $\frac{1}{\eta} \;=\; P_F \frac{F}{P}$ and η represents the industry price elasticity of demand.

Dividing through by *e* gives our first-order condition in employment-setting :

$$\pi_L \;=\; PF'(.)\left\{ 1 + \frac{1}{\eta} \right\} - \frac{W}{e} \;=\; 0 \qquad (8)$$

such that the efficiency wage, *(W/e),* will be set to equal the marginal revenue product of labour.

Partial differentiation of (7b) w.r.t. the wage, w, gives,

$$\pi_W \;=\; P_F\, F'(.)e_W\, L\,F(.) \;+\; F'(.)e_W\, L\,P - L \;=\; 0$$

$$\pi_W \;=\; PF'(.)\left\{ \frac{P_F}{P} L e_w\, F(.) + L e_W \right\} - L \;=\; 0$$

again given that $\frac{1}{\eta} \;=\; P_F \frac{F}{P}$ and taking out $L\ e_w$ as a common factor for the term in parentheses, we have :

$$\pi_W \;=\; PF'(.)\left\{ 1 + \frac{1}{\eta} \right\} L e_W \;-\; L \;=\; 0$$

Now dividing through by $L\ e_W$,

$$\pi_W \;=\; PF'(.)\left\{ 1 + \frac{1}{\eta} \right\} \;-\; \frac{1}{e_W} \;=\; 0 \qquad (9)$$

From Equations (8) and (9), it is clear that :

$$\frac{W}{e} = \frac{1}{e_W} \quad \Rightarrow \quad \varepsilon \equiv \left(\frac{\partial e}{\partial W}\right)\left(\frac{W}{e}\right) = 1 \qquad (10)$$

such that the familiar Solow Condition (Solow, 1979) holds. The efficiency wage will be set at a level at which the elasticity of effort with respect to the wage is unity.

The following comparative static properties of the model may then be derived with respect to the parameter γ, variations in which under the efficiency wage model explains why some firms pay more :

$$W_\gamma > 0 \qquad \left(\frac{W}{e}\right)_\gamma < 0 \qquad \pi_\gamma > 0$$

Some intuition for these results might run as follows. Following an increase in γ the firm offers a higher wage since at any wage, effort is now more responsive to the wage rate. The firm continues to set wages according to the Solow condition (Equation 10) such that effort will rise by a greater amount than does the wage. The efficiency wage falls. From Equation 8 we know that the marginal revenue product of labour will also have fallen. This results from an extension along a labour demand curve as employment increases. As the levels of employment and effort increase so too does output and given that the wage per unit effort has fallen, it should be clear that profits will rise.

C A Competitive Model

In a purely competitive model there should exist no correlation between wages and profits in response to demand shocks. Empirically, the issue to which we will address ourselves will be why some firms pay more than others and the relation between this wage premium and product market performance. Hence we are looking for something idiosyncratic to an individual firm. In a purely competitive model however, demand shocks have no effect on the wage as adjustment falls wholly on the level of employment. On the supply-side, compensating differentials may be present. However they do not predict a relation with profitability. In a competitive model subject to frictions, Blanchflower and Oswald (1994) show that a positive relation between wages and profits can result from demand shocks. Demand shocks, μ, impact positively upon both wages and profits as labour supply to the firm, $l(W)$, is less than perfectly elastic, $l'(W) > 0$. We should note however that the principal rationale for an upwardly-sloped labour supply curve to the firm would be if quits were a negative function of the wage, in which case the model corresponds to the efficiency wage model of Salop (1979). We adopt this interpretation in the present analysis.

The context of a performance equation in which to examine alternative models of wage determination has been adopted in a number of previous studies. Notable examples include Machin and Manning (1992), Wadhwani and Wall (1991) and Levine (1992), as well as Konings and Walsh (1994). The central argument of each is that under efficiency wage theory, a positive wage effect is to be observed in an estimated equation for company performance.

We now aim to confront the varying theoretical predictions outlined in this section with UK data - for which we must first formulate our empirical model.

3 Empirical Model

On the basis of the above considerations and borrowing from the wide Industrial Organisation literature on company profitability (e.g. Machin and Van Reenen, 1993) we arrive at an estimable linear model for firm profitability of the form :

$$\begin{aligned}(\pi / K)_{it} = f_i + \beta_1(\pi / K)_{it-1} + \beta_2 mktsh_{it} + \beta_3 mktsh_{it-1} + \beta_4 conc_{jt} + \beta_5 conc_{jt-1} \\ + \beta_6 w_{it} + \beta_7 w_{it-1} + \beta_8 hds_{it} + \beta_9 hds_{it-1} + \psi_t + \varepsilon_{it}\end{aligned} \tag{11}$$

where in the dependent variable, profits are normalised on capital stock rather than sales since under certain efficiency wage models higher-paying firms will have proportionately greater sales than they do profits - implying that their margins are *lower,* ceteris paribus. The measure of capital stock employed in calculating the denominator of the dependent variable is valued at replacement rather than historic cost (see Nickell *et al.*, 1992). The inclusion of a lagged dependent variable, $(\pi / K)_{it-1}$, is suggested by the persistence of profits literature (see Mueller, 1990). Geroski (1988) illustrates how the persistence term may be considered as representing an inverse measure of the efficacy of actual and potential competition in ensuring convergence of profits. The market share (mktsh) and industry concentration (conc) terms are standard in explaining firm profitability, with prior research leading us to anticipate the market share effect will dominate that of industry concentration. We may note however that here we are able to use a Herfindahl index proxy as the measure for industry concentration (see Data Appendix for further details); w_{it} is the average wage of the firm with hds_{it} as the highest paid director's salary and bonus pay; f_i represents the firm-specific fixed effects upon company profitability; ψ_t represents a vector of time effects reflecting macroeconomic shocks common to all firms in a given year; ε_{it} is a mean zero, serially uncorrelated error term.

It should be made clear that in estimation of Equation 11 and consideration of a positive versus negative relation between pay and performance, we require to have adequately 'netted out' the reverse causation resulting from 'ability to pay' type effects. Our estimation method, an instrumental variables technique, offers the best opportunity to achieve this.

A further concern is to consider whether bargaining is more likely, the greater is the market dominance of the firm. Given that market power (for efficiency or strategic reasons) implies the presence of rents, if bargaining takes on greater significance in such circumstances then this might be interpreted as constituting evidence of rent-capture. Again, we may compare the significance of rent-capture in the case of both employee and executive levels of the firm.

The Data

The source of data for our analysis is the Datastream International database of company accounts. This offers detailed firm-level financial information on UK quoted companies. The data set used for our estimation consists of observations on 554 manufacturing companies over the period 1986-1994 (after allowing for lagging and instrumentation). From the population of quoted companies present on the Datastream database, standard selection criteria were employed to arrive at this sample of firms, i.e. that the firm's main operating activity was in manufacturing and that the company had a minimum of four continuous observations during the period 1984-94. Appendix Table A1 presents summary statistics on the main variables of interest. A number of points require comment. First, it is to be understood that since the panel is unbalanced, the mean figures for each year will refer to a different set of companies depending on the year in question. Interpreting movements across years as representing rates of change in that variable is therefore not strictly valid i.e. compositional effects will be present.

Nevertheless, a number of familiar patterns emerge. The marked growth in company profitability over the 1980s is clear, as is its subsequent decline in the recession from 1989/90. The overall growth in executive pay over this period has been noted elsewhere (e.g. Conyon *et al.,* 1995). The large standard deviations for this variable across a large sample of private sector companies are not surprising. The trend in, and level of, within-company, average employee pay also displays a plausible pattern.

Estimation Method

Estimation of Equation 11 is carried out by employing the Generalised Method of Moments estimator of Arellano and Bond (1988, 1991). This GMM estimator represents an efficient extension of the instrumental variable estimator of Anderson and Hsaio (1982) where the source of the efficiency gains lies in the addition of further instruments for the endogenous variable(s) as one proceeds through the panel (i.e. as 't' increases).

Several variables in Equation 11 suggest themselves as being endogenous, most notably the market share and wage terms, w and hds. In addition, the lagged dependent variable also needs to be instrumented in fixed effects models (Nickell, 1981). If Equation 11 is first differenced, Arellano and Bond (1991) show that valid instruments for the endogenous variable can be the levels of the endogenous variable dated t-2 and earlier. The validity of the estimation method depends crucially upon the absence of serial correlation in the levels model. This implies the absence of second-order serial correlation in the estimated equation for which Arellano and Bond (1991) provide a test statistic (reported as m_2 below), in addition to the need to report conventional tests for instrument validity.

4 Estimation and Results

Table 1 contains the results from estimation of Equation 11 over the unbalanced panel of 554 firms and the period 1986-94.[3]

First however we consider the issue of the persistence of profits in isolation. The persistence of profits argument is simply picked up by the presence of a lagged dependent

[3] All models are estimated using D.P.D., a program written in GAUSS for obtaining GMM estimates of dynamic models from unbalanced panel data, see Arellano and Bond (1988).

variable. The term is highly significant with a coefficient value very similar to previous studies for the UK i.e. between 0.5 and 0.6. Thus even over the period 1986-94, commonly described as one during which the degree of competition increased relative to earlier periods, a significant degree of persistence to profitability is present. A strong case can be made for the argument that notions of the degree of competition present in product markets should be based on the persistence of profits rather than their level in any individual period. Thus high levels of profits need not be of concern to the policy-maker provided that market processes are sufficiently swift such that they are eroded. Our results tend to suggest that these competitive forces do not act very rapidly and have not increased relative to earlier periods for which similar estimation results exist.

The results in terms of the other product market terms introduced in column 2 are also conventional. Schmalensee (1989) describes the negative influence of industry concentration - when controlling for market share - as representing a stylised fact of similar studies. It is interpreted as suggesting that for given market share, firms in more concentrated industries face more rivalrous competition.

However, our immediate focus of attention is centred on the sign and significance of the wage terms, w_{it} and hds_{it}. Prima facie, the results in terms of the employee level wage are consistent with the results of Konings and Walsh (1994). Konings and Walsh (1994) report a significant negative coefficient on the employee wage term for a sample of firms in highly unionised industries (defined according to the median level of union density) and significant positive coefficient for the sample of firms whose industries are lowly unionised - they do not provide estimates for the joint sample.

In the case of the highest-paid director salary, the results indicate a positive spillover from wages to profits which we take as evidence in favour of the efficiency wage or competitive with frictions models. The suggestion that efficiency wage issues are relevant in determining executive-level pay would be consistent with the argument that partly responsible for the growth in executive pay over the 1980s was an increasing premium to be placed on recruitment, retention and motivation of such executives. In turn, this might be considered in keeping with a more general analysis of widening pay inequality considered by Gregg and Machin (1994). Gregg and Machin (1994) argue that much of the rising income inequality over the 1980s can be explained in terms of a basic supply and demand framework. Our analysis of efficiency wage models in the general sense of representing the premium associated with recruitment, retention and motivation of highly-skilled labour fits this story. Finally, we should also emphasise that the reported diagnostic tests for our specifications contained in Table 1, do not suggest that our instrument set is invalid leading to inconsistent estimates.

Wages, Bargaining and Rent-Capture

We now go on to consider the issue of rent-capture by an analysis of whether the forces of wage determination at employee and executive levels identified above, vary according to the product market position enjoyed by the employing firm.

Table 2 contains our results for the interactions model employed to do so. The results suggest the presence of rent-capture in both employee and executive pay determination. Estimation results for the unrestricted model are presented in column 1. On the basis of a Wald Test ($\chi^2(4) = 1.90$) we arrive at a more parsimonious representation in column 2. The results suggest that the negative relation between pay levels and product market performance implied by bargaining takes on greater significance in firms enjoying greater market power. A Wald test of the joint significance of these two interaction terms under the one-step estimates, gives a test statistic value of $\chi^2(2) = 10.92$. This is significant at the 1 % level and we interpret this as evidence of rent capture. Column 3 presents the results for the two-step GMM estimates according to which the case for rent-capture is reinforced.

Previous discussions of rent-capture have been largely confined to the employee level and have developed in the direction of attempting to identify the source of rents that are captured (e.g. Van Reenen, 1996) such as in the form of wage gains. Our results appear to have implications for research into the presence of market power. In reviewing this literature, Geroski (1988) concludes that such evidence exists but the suspicion remains that the associated rents may become dissipated within the firm. Our results would support this conclusion and identify one further source of absorption of profits. Rent-capture by executives has not been addressed in previous studies of executive pay which focus upon the extent to which pay depends upon (typically share price) performance implying the provision of incentives to maximise shareholder return (Jensen and Murphy, 1990).

5 Concluding Remarks

In this Chapter we have considered models of wage determination and how their significance may differ between levels of the firm, focusing upon the employee - executive distinction.

In an analysis of product market performance, evidence for the implied positive spillover from the wage under efficiency wage theory was found at the executive level. At the employee level we did not find evidence of a significant wage effect in our performance equation. The suggestion that efficiency wages should have greater significance at the executive relative to the employee level, where problems of monitoring are presumably less severe, would seem to accord well with the intuition behind efficiency wage theory. (E.g. Krueger, 1991). It also has the further implication that observed wage differentials between executives and employees should exceed that which could be attributed to skill differences alone.

However, at both levels of the firm, bargaining was observed as a more significant phenomenon alongside increases in higher market share. This was interpreted as evidence of rent-capture in the determination of both employee and executive pay. Whilst the case for employees being able to capture a portion of product market rents has been made elsewhere, a similar case for executives has been absent from the recent literature on executive pay. Among firms which dominate their product markets, it appears that rent-sharing - in the sense of bargaining - may apply equally to executives as it does to employees.

Table 1 : Rent-Sharing and Firm Profitability, 1986-94
Dependent Variable : $(\pi / K)_{it}$

constant	0.0065 (0.0145)	0.0146 (0.0142)	0.0121 (0.0141)
$(\pi / K)_{it-1}$	0.5499 (0.0901)	0.5797 (0.0824)	0.5832 (0.0841)
market share$_{it}$		0.7651 (0.4191)	0.8085 (0.2879)
market share$_{it-1}$		0.3455 (0.7775)	
industry concentration$_{jt}$		-0.8790 (0.2947)	-0.9420 (0.3095)
industry concentration$_{jt-1}$		-0.1540 (0.3547)	
employee wage$_{it}$		-0.0153 (0.0154)	-0.0083 (0.0076)
employee wage$_{it-1}$		0.0083 (0.0112)	
*highest paid director salary$_{it}$		0.0331 (0.0141)	0.0379 (0.0140)
*highest paid director salary$_{it-1}$		0.0134 (0.0094)	
time dummies	yes	yes	yes
m_2	0.629	0.576	0.592
Sargan	46.28 (35)	164.68 (162)	169.95 (166)
Wald(1)	37.25 (1)	75.05 (9)	72.50 (5)
Wald(2)	98.61 (9)	93.61 (9)	91.70 (9)
Wald(3)		3.30 (4)	
companies	554	554	554
observations	3989	3989	3989

Notes To Table 1 :

1. All models are estimated in first-differences ; one-step heteroskedastic-consistent standard errors in parentheses.
2. Wald(1) is a Wald test of the joint significance of the included regressors
   Wald(2) is a Wald test of the joint significance of the time dummies;
   Wald(3) is a Wald test of the joint significance of the regressors in the unrestricted model (column 2) which are then dropped in our restricted model (column 3).
3. Sargan is a Sargan test of instrument validity, distributed χ^2(df)
4. $m_2 \sim_a N(0,1)$ and is a test of second-order serial correlation (Arellano and Bond, 1991).
5. Instruments used are lags of t-2 and earlier (where available).
   Variables treated as endogenous are $(\pi/K)_{it-1}$, mktsh, w , hds.
6. * denotes that coefficient and standard error are multiplied by 100.

Table 2 : Rent-Sharing and Firm Profitability, 1986-94
Dependent Variable : $(\pi / K)_{it}$

	GMM1	GMM1	GMM2
constant	0.0062 (0.0145)	0.0038 (0.0144)	0.0060 (0.0026)
$(\pi / K)_{it-1}$	0.5769 (0.0812)	0.5838 (0.0805)	0.5857 (0.0075)
market share$_{it}$	0.2495 (0.5182)		
market share$_{it-1}$	1.4760 (0.6780)	1.8385 (0.5680)	1.6842 (0.0634)
industry concentration$_{jt}$	-0.6401 (0.2201)		
industry concentration$_{jt-1}$	-0.0525 (0.2560)	-0.2982 (0.2472)	-0.2900 (0.0303)
employee wage$_{it}$	-0.0099 (0.0137)	-0.0102 (0.0114)	-0.0087 (0.0007)
employee wage$_{it-1}$	0.0053 (0.0105)	0.0078 (0.0095)	0.0070 (0.0011)
*highest paid director salary$_{it}$	0.0520 (0.0207)	0.0509 (0.0163)	0.0449 (0.0018)
*highest paid director salary$_{it-1}$	0.0309 (0.0169)	0.0318 (0.0156)	0.0281 (0.0014)
(employee wage X market share)$_{it}$	0.0041 (0.0300)		
(employee wage X market share)$_{it-1}$	-0.0520 (0.0305)	-0.0646 (0.0276)	-0.0599 (0.0025)
*(highest director salary X market share)$_{it}$	-0.0156 (0.0478)		
*(highest director salary X market share)$_{it-1}$	-0.0834 (0.0537)	-0.0901 (0.0466)	-0.0787 (0.0047)
time dummies	yes	yes	yes
m_2	0.601	0.636	0.642
Sargan	254.29 (248)	265.01 (252)	265.01 (252)
Wald(1)	94.02 (13)	82.24 (9)	7991.32 (9)
Wald(2)	101.28 (9)	104.13 (9)	29423.92 (9)
Wald(3)	1.40 (4)		
companies	554	554	554
observations	3989	3989	3989

Notes to Table 2 :

1. All models are estimated in first-differences ; GMM1 refers to one-step estimator heteroskedastic-consistent standard errors in parentheses; GMM2 refers to two-step estimator.
2. Wald(1) is a Wald test of the joint significance of the included regressors
Wald(2) is a Wald test of the joint significance of the time dummies;
Wald(3) is a Wald test of the joint significance of the regressors in the unrestricted model (column 1) which are then dropped in our restricted model (column 2).
3. Sargan is a Sargan test of instrument validity, distributed χ^2(df)
4. $m_2 \sim_a N(0,1)$ and is a test of second-order serial correlation (Arellano and Bond, 1991).
5. Instruments used are lags of t-2 and earlier.
Variables treated as endogenous are $(\pi/K)_{it-1}$, mktsh, w , hds and their interactions
6. * denotes that coefficient and standard error are multiplied by 100.

Data Appendix

Appendix Table A1. Summary statistics on key variables
Means (standard deviations)

	Return on Assets	Market Share	Herfindahl	Highest Director Emoluments ($£_{1990}$000s)	Employee Wage ($£_{1990}$ 000s)
1984	0.2086 (0.2512)	0.0603 (0.1158)	0.1645 (0.1171)	91.3197 (81.2124)	11.0986 (4.1595)
1985	0.2546 (0.3394)	0.05802 (0.1137)	0.1761 (0.1261)	96.6588 (85.5740)	11.3386 (4.1362)
1986	0.2748 (0.3243)	0.0595 (0.1162)	0.1877 (0.1312)	105.4325 (82.2801)	11.8477 (4.0912)
1987	0.3261 (0.3728)	0.0592 (0.1179)	0.1977 (0.1369)	118.4303 (85.5498)	12.5461 (4.3306)
1988	0.3633 (0.3513)	0.0589 (0.1195)	0.2176 (0.1518)	131.6575 (97.8020)	12.7812 (4.4232)
1989	0.3742 (0.3989)	0.0579 (0.1209)	0.2288 (0.1615)	137.8622 (114.0806)	13.0481 (4.3834)
1990	0.3493 (0.3636)	0.0577 (0.1237)	0.2357 (0.1627)	137.5642 (118.7390)	12.8825 (4.0190)
1991	0.2472 (0.2871)	0.0583 (0.1237)	0.2448 (0.1679)	141.1004 (142.0532)	13.0024 (4.0271)
1992	0.2210 (0.2655)	0.0591 (0.1248)	0.2485 (0.1711)	142.4561 (118.5602)	13.3692 (3.9615)
1993	0.2192 (0.3115)	0.0582 (0.1172)	0.2181 (0.1654)	166.2581 (157.2480)	13.8314 (4.3050)
1994	0.2709 (0.3097)	0.0688 (0.1213)	0.1586 (0.1366)	187.7395 (190.5338)	13.8770 (4.2964)
1984-1994	0.2833 (0.3331)	0.0595 (0.1199)	0.2113 (0.1546)	134.9237 (125.3689)	12.7946 (4.2687)

Notes.

see Table A.4.

<u>Table A.2</u> : Sample Size

The panel is unbalanced with a minimum of four records per company. The dataset consists of the following number of observations per year:

Year	Companies per year
1984	341
1985	382
1986	401
1987	426
1988	454
1989	496
1990	527
1991	551
1992	551
1993	545
1994	423
Total	5097

<u>Table A.3</u>

The number of records per company is given by :

Number of Records	Companies
4	33
5	37
6	40
7	24
8	24
9	29
10	118
11	249
Total number of companies	554

Sample Selection Criteria

The sample was selected on the basis of having a minimum of four continuous observations over the period 1984-94 and belonging to primary, manufacturing or construction industries (i.e SIC 100-500). From the resulting sample of firms and industries, Tobacco was deleted on the grounds that it is dominated by one firm. According to Machin and Van Reenen (1993), this is likely to imply an underestimate of industry sales to which the firm has been categorised on the basis of its *principal* operating activity. Our final sample consists of 554 companies belonging to 40 industries. This is derived from the same dataset employed in Chapter 5. The sample sizes differ since first, in the present chapter we consider less deep lags and can therefore select on having a smaller number of minimum time-series observations per company; second, the present sample does not require the availability of company share price data.

<u>Table A.4</u> : Data Definition and Description

Variable
<u>Profits</u> : Datastream Item 137. This is defined as total profits from normal activities of the company after depreciation and operating provisions (exceptional items).
<u>Capital</u> : The measurement issue here is to convert measures at historic cost for plant and machinery (Datastream Item 328) and for buildings (Datastream Item 327) to measures calculated on a replacement cost basis. To this end, the procedure detailed in Nickell, Wadhwani and Wall (1992) was employed (see also Blundell *et al.*, 1992). Essentially, this involves the use of the perpetual inventory formula after calculating the proportion of new investment in plant and machinery (buildings) as the ratio of of the change in the historic cost of plant and machinery (buildings) to the sum of the changes in the two forms of assets. It assumes particular annual rates of depreciation for plant and machinery (8%) and for buildings (2.5%). Price indices for plant and machinery and buildings (Source : Business Monitor) are then used to convert to a current cost basis.
<u>Market Share</u>. We follow the definition used in Nickell *et al.,* (1992); Industry sales is calculated as : $$TSALS_{jt} = N_j * AVSALS_{jt}$$ where $AVSALS_{jt}$ = average sales of a firm in industry j at year t N_j = number of firms in industry j in a chosen base year (1990) Market Share is then obtained as $$Mktsh_{it} = Sales_{it} / TSALS_{jt}$$ where $Sales_{it}$ is Datasteam Item 104 (total company sales).

Herfindahl Index of Concentration Constructed from sales data (Σmarket share$_i^2$; for i=1...n where 'n' is the number of firms in the industry) of Datastream. Firms are classified by Datastream industry code.
Employee Wage : We take the nominal employee wage to be given by : w = total employee remuneration / total number of employees where total wage bill is Datastream Item 215 total number of employees is Datastream Item 219 To obtain a real wage rate we deflate 'w' by the retail price index. An issue which has been commented upon in previous panel data models using wage data has been the use of a domestic wage variable rather than one which applies to the company as a whole (although Hildreth and Oswald (1994) do use the latter). This has been necessary where such studies have traversed 1982 when a change in the convention for reporting company accounts data resulted in companies reporting domestic wage data prior to this date but only a minority continuing to do so after 1982 (instead reporting total company wage bill and employment levels). Given that our analysis is from 1984 onwards, we use a wage for the company as a whole. We consider the relevant issue to be the use of a consistent measure of wages throughout a sample period rather than of a domestic wage per se. In any case, given that the dependent variable is defined in terms of total company profits, this seems the most appropriate measure.
Highest-paid Director salary Source : Datastream Item 244 deflated by the retail price index. This includes salary, bonus and benefits but excludes share options and equity.

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Chapter 7

Wage Premia in Public and Private Sector Labour Markets

Abstract :

The Chapter considers the estimation of wage differentials both between and within public and private sector labour markets, employing data from the 1991 British Household Panel Survey. Evidence of a pay penalty for individuals employed in the National Health Service or Higher Education sectors is found, after controlling for a range of individual and job characteristics. This is estimated at 10 - 12 % relative to those employed in local government or local services. Differences in wage premia on the basis of education, workplace size, gender and union presence between public and private sectors are also found.

Chapter 7

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Abstract :

The Chapter considers the estimation of wage differentials both between and within public and private sector labour markets, employing data from the 1991 British Household Panel Survey. Evidence for a large wage premium for women employed in the public sector is found, after controlling for a range of individual and job characteristics. The mean differential, evaluated at public sector means, is estimated at 30 %. The size of this differential depends crucially upon the inclusion of controls for industry, reflecting the fact that public sector employment tends to be concentrated in low-paying service sector jobs.

Employees in the National Health Service or State Higher Education sectors experience a 10 - 12 % pay penalty relative to those employed in local government or local services.

Differences in wage premia on the basis of education, workplace size, gender and union presence between public and private sectors are also found.

1 Introduction

A fundamental distinction that exists within the British labour market is that which can be made on the basis of the public versus private sectors with approximately one in four full-time employees being employed in the public sector. Despite this importance which one might assign to the public sector, it is clear that the overwhelming majority of empirical studies of wage determination in Great Britain restrict their attention to the private sector. The possibility presents itself that there is something inherently different in the public sector which calls for a separate study of wage determination. As a source of variation in the way in which wages are determined, this possibility has not, however, been the focus of prior research.

There are several characteristics of the public sector which make it an interesting sector of the labour market to consider. For many public services, the employer is the sole provider of that particular service; it is therefore subject to little international competition with public sector employment also being heavily weighted towards service occupations (Brown and Walsh, 1991). In addition, although the private sector may be motivated by profit maximisation, such concerns are likely to be of less relevance in the public sector (Ehrenberg and Schwartz, 1986).

A concern for motivating research on the basis of consequences for public policy further suggests the importance of an analysis of such issues since the public sector is by definition a sector on which much public policy is concentrated. Moreover, successive rounds of pay determination within the public sector raise a debate regarding pay-setting in this sector and comparability with the private sector. Such pay comparability will represent an important determinant of the ability of the public sector to recruit, retain and motivate its employees. This debate does not however appear to be an informed debate on the basis of evidence regarding existing ceteris paribus wage differentials[1]. The motivation for the present research should therefore be clear. It reflects a combination of the importance of examining the

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[1] A number of studies do however, trace the behaviour of the raw public-private sector earnings ratio over time for particular occupations (e.g. Gregory, 1990; Elliott and Duffus, 1996). For U.S. evidence concerning government differentials see, inter alia, Smith (1976), Venti (1987), Gyourko and Tracy (1988) and Poterba and Reubens (1994).

relation between public versus private sector wage determination in Great Britain and the lack of detailed research in this area.

The starting point to our analysis will therefore be to estimate the wage differential associated with affiliation to the public sector as well as that additional differential associated with different types of public sector labour markets. Estimation of some average wage differential immediately focuses one's attention upon variation around the average. We consider such variation both according to different employee characteristics, such as levels of education, gender and union membership, as well as that associated with the estimation of different quantiles of the wage distribution. In so doing we also provide the first estimates for Great Britain of these additional wage differentials at different points in the wage distribution.

Furthermore, a consideration of the public sector provides scope for a detailed analysis of several additional issues which have long concerned those modelling wage determination in the private sector. Hence it will be possible to consider how estimated differentials according to characteristics such as education, union presence, gender and workplace size also vary between those estimated within the public and private sectors. Reflecting these innovations, we are able to provide several new results regarding wage determination in the British labour market.

The rest of the paper is organised as follows. Section 2 describes the relevant econometric considerations in the context of estimating inter-sectoral wage differentials. We discuss both standard wage decomposition techniques, following Oaxaca (1973) and quantile regression methods (Koenker and Bassett, 1978). Estimation results, employing individual-level cross-section data from the 1991 British Household Panel Survey are presented in Section 3. Concluding remarks are offered in Section 4.

2 Estimation Methodology

In the present section we provide an account of the relevant econometric specifications for our empirical analysis of wage differentials both between and within public and private sectors of the British labour market. This proceeds in two main stages. First, we describe the relatively familiar Oaxaca (1973) decomposition of wage differentials on the basis of some particular characteristic. The procedure decomposes a raw average wage difference into that which one may ascribe to differences in characteristics and the wage differential in the form of the way in which given characteristics are rewarded differently across the two sectors in question.

Second, in order to explore in further detail the nature of wage differentials in public and private sector labour markets, we consider estimation of different quantiles of the conditional wage distribution. We therefore also discuss the application of quantile regression methods to our analysis. This provides scope for a more detailed analysis of wage-setting factors in the British labour market.

2.1 Wage Differentials

Let us consider the partitioning of the labour market into two sectors, A and B. We allow wage determination to differ between the two sectors by allowing the coefficients on each of our covariates to vary between the two sectors. We therefore specify the following two estimating equations :

$$\ln w_A = X_A' \beta_A + \varepsilon_A \quad (1)$$

$$\ln w_B = X_B' \beta_B + \varepsilon_B \quad (2)$$

where 'w' refers to the hourly wage rate for an individual with vector of characteristics X, associated parameter vector β, and random error term, ε. An alternative approach might be to impose common coefficients across the two sectors, evaluating the differential as the coefficient on an additive dummy variable in a single equation model.

One may define the average raw wage differential between sectors A and B on the basis of Equations 1 and 2 as : $\ln G = \overline{\ln w_A} - \overline{\ln w_B}$, where the upper bar denotes the average pertaining to that sector. In turn, one may substitute, $\ln \overline{w_A} = \overline{X_A}' \hat{\beta}_A$; $\ln \overline{w_B} = \overline{X_B}' \hat{\beta}_B$ to obtain , $\ln G = \overline{X_A}' \hat{\beta}_A - \overline{X_B}' \hat{\beta}_B$; The differences in mean observed characteristics may then be derived as, $\Delta\overline{X} = \overline{X_A} - \overline{X_B}$ and differences in returns across the two sectors, $\Delta\hat{\beta} = \hat{\beta}_B - \hat{\beta}_A$. If we choose to substitute $\hat{\beta}_A = \hat{\beta}_B - \Delta\hat{\beta}$ into the expression for ln G, we can arrive at the following convenient decomposition of the raw wage difference between sectors A and B :

$$\ln G = \overline{\Delta X}' \hat{\beta}_B - \overline{X_A}' \Delta\hat{\beta} \quad (3)$$

Thus, following Oaxaca (1973) the term, $\overline{\Delta X}' \hat{\beta}_B$, may be interpreted as the estimated effect of differences in individual characteristics whilst, $-\overline{X_A}' \Delta\hat{\beta}$, reflects variation in the way in which given characteristics are rewarded in the two sectors, evaluated at the means of the sector A group. It is to this latter that we refer when we estimate the wage differential (in log points) between the two sectors. The proportional wage differential is then given by $\delta = \exp(\gamma) - 1$, where $\gamma = -\overline{X_A}' \Delta\hat{\beta}$.

In the context of estimating the union wage differential, Stewart (1983) notes that such an estimate considers the ceteris paribus premium enjoyed by a sector A individual over that which he / she would earn in sector B.

In the subsequent regression analysis, we present results for a number of differentials estimated in the manner of the procedure described above, standard errors being calculated following the method detailed in Stewart (1987). Our starting point is the evaluation of the overall average government status (i.e. public versus private sector) wage differential. We then stratify our sample by gender and by union membership and evaluate the government status differential separately for these groups of individuals. Moreover, our analysis provides scope for consideration of how these gender and union wage differentials as well as the returns to education and workplace size, vary between the public and private sectors of the British labour market.

2.2 Quantile Regression Methods

In order to gain further insight into forms of variation around an estimated wage differential, we may consider the estimation of different quantiles of the conditional (log) wage distribution. Thus whilst standard least squares methods provide an estimate of the mean log wage (conditional on our regressor set), quantile regression methods facilitate the estimation of several alternative quantiles of the wage distribution. This should therefore provide a more detailed account of the conditional wage distribution. Moreover, there may exist further reasons as to why the use of quantile methods may be preferred over, or alongside, least squares estimation. Thus much of the case made by Koenker and Bassett (1978) for a quantile regression approach is based upon the desire for robustness in regression analysis and reduced sensitivity to outlying observations.

In the first instance, we consider the qth quantile of the conditional log wage distribution to be a linear function of the regressor variables, X :

$$Quantile_q(\ln w|X) = X'\beta_q + \sum_{j=1}^{k}\gamma_{qj}D_j \qquad (4)$$

In applying our quantile regression methods we will therefore estimate a single equation model across both public and private sectors with government status being represented by 'k' additive dummy variables denoting a particular form of public sector affiliation. We are able to distinguish between central government, local government (which includes local services such as local education, fire and police), the National Health Service or state Higher Education and nationalised industry[2].

The minimising criterion for the above programming problem is to choose the vector (β_q , γ_q) which minimises the following expression :

$$\min_{\beta\gamma}\left[\sum_{r<0} q\left|\ln w - X'\beta_q - \sum_{j=1}^{k}\gamma_{qj}D_j\right| + \sum_{r>0}(1-q)\left|\ln w - X'\beta_q - \sum\gamma_{qj}D_j\right|\right]$$

where 'r' represents the residual , $r_i \;=\; \ln w - X'\beta_q - \sum\gamma_{qj}D_j$.

Thus in the special case of the median regression model, where q = 0.5, the minimising criterion is the least absolute error and the case for the robustness properties of the approach becomes clear (see Koenker and Bassett, 1978). Standard errors are calculated from the analytic variance-covariance matrix, $\text{cov}(\beta) \;=\; (X'X)^{-1} R_1 (X'X)^{-1}$ where the matrices are now defined appropriately to include the terms in the public sector variables; $R_1 \;=\; X'WW'X$ and $W \;=\; diag\left[(q|_{r>0} + (1-q)|_{r<0}) / f_r(0)\right.$; $f_r(0)$ denotes the estimator of the density of the residuals at zero ; see Rogers (1993) regarding the estimation of this density.

Recent applications of quantile regression methods include Chamberlain (1994), Buchinsky (1994) and Poterba and Reuben (1994). Similar techniques are also applied by Gosling, Machin and Meghir (1996) in order to examine the changing distribution of male wages in the U.K. over the period 1966 to 1992. Chamberlain (1994) proposes and implements a minimum distance estimator but applies the linear programming algorithm adopted here, in the case where the number of covariates exceeds beyond a very small number.

3 Estimation Results

The estimation of inter-sectoral wage differentials has been of prime concern in understanding wage determination and hence the functioning of separate labour markets in general. We have

[2] The data do not allow further disaggregation within these specified categories.

made a case for arguing that the differential on the basis of government status is of special importance for a number a reasons. We now go on to estimate this mean differential across our sample of individuals in the British Household Panel Survey of 1991, as well as the additional differential associated with particular types of public sector affiliation. Further variations around this overall mean differential are then also considered.

The sole prior study for Great Britain which estimates a government status differential is that by Rees and Shah (1995). Rees and Shah (1995) employ General Household Survey data for 1983, 1985 and 1987. The estimates obtained suggest a small negative differential for men of 0.02 in the case of the 1983 and 1987 cross-sections, although the estimated differential for 1985 is -0.33, with an estimated large pay premium for women of approximately 0.30. (Standard errors for these differentials are not calculated). In addition to evaluating the nature of these differentials in finer detail, an advantage of our dataset is the ability to distinguish between different sectors within the public sector as a whole. In addition to examining the government differentials we also consider in greater detail estimated differentials within the public and private sectors of the labour market.

3.1 The Data

The data employed in our analysis is derived from the British Household Panel Survey of 1991. The BHPS represents a household- and individual-level, nationally representative survey. The dataset consists of more than 5 000 households and 10 000 individuals conducted between September and December 1991. Our sample is restricted to those individuals aged between 16 and 65, employed in either the public or private sectors, working at least 30 hours per week and providing relevant data on each of the variables employed in the analysis.

Our specifications include a set of standard human capital and demographic explanatory variables for the determination of individual-level (log) hourly earnings. Dummy variables indicating the highest academic qualification are therefore included alongside binary variables for employer size, union presence - membership and coverage at place of work - race and gender. Additional controls for (potential) experience, job tenure (i.e. tenure in the current position at the firm), health status and managerial status are also included alongside occupational, industry and regional dummies. The dependent variables consists of the log of hourly earnings. This is derived from a point-in-time measure of earnings, generally preferred over annual measures, and hours worked per week (see Benito, 1997, for further details).

Table 1 presents our estimation results for the estimation of separate earnings equations according to government status and gender for our selected sample of the BHPS. There is evidence of a positive mean government status differential for women, estimated at 32 %. The mean differential for men is insignificantly different from zero. For comparison purposes we note that the estimation of a single equation model otherwise equivalent to that of Table 1, with a single additive dummy variable for public sector status reveals a coefficient (standard error) on the public sector term of 0.007 (0.034) for males and 0.249 (0.044) for females. The results also suggest a public sector pay penalty of 10 % for public sector male employees who are employed in the National Health Service (N.H.S.) or State Higher Education sector relative to those employed in Local Government or local services, although the coefficient is not especially well-determined with a standard error of 0.057. For women, there is also evidence of variation between categories within the public sector. Employees in the National Health Service or State Higher Education category again are estimated to experience a pay penalty relative to local government employees, in this case of the order of 13 %.

It is of further interest to consider the returns to individual characteristics in the public sector in some more detail. The returns to levels of educational attainment appear to be higher, for women, in the public relative to the private sector with the possible exception being in terms of the returns to a degree or higher qualification. The major positive differences occur in terms of the rewards to O-levels and A-levels with higher returns to Nursing and Teaching qualifications for women also being estimated in the public sector. For males, we estimate no marked distinction between the returns to educational levels in the public and private sectors, again with the possible exception of lower returns to a first or higher degree in the public sector.

The differential associated with workplace size, which Green *et al* (1996) ascribe, at least in part, to monopsony, is more pronounced in the private sector. As pointed out by Green *et al* (1996, p. 435), given that wage-setting in the public sector occurs at a more centralised level, one would not expect any monopsony argument to be appropriately proxied by workplace size in this sector. This nevertheless makes the possibility of a size differential in the public sector, albeit one which is rather less pronounced than in the private sector, an interesting one. There is also evidence of a race wage differential (i.e. on the basis of a white / non-white distinction) for both men and women in the public sector but not the private sector. We are however, somewhat reluctant to attach too great a significance to such an inference given the small cell sizes on which these estimates rely, with only 11 (23) males (females) being classed as 'non-white' in our public sector samples[3]. We also note that the total union wage differential in the private sector, which is similar in magnitude for both males and females at approximately 10 %, follows a different pattern in the public sector, being more particularly associated with coverage rather than individual membership. We note that 97 % of individuals in the public sector in our dataset report that they are employed at a place of work which recognises a trade union for bargaining purposes, with 78 % of employees being union members. The coverage differential is only significant for males but again on estimating separate equations by gender these estimates rely on small cell sizes (see Andrews *et al*, 1996, regarding the estimation of cross-sectional union wage differentials in Great Britain).

The wage premium associated with being married (or living as a couple), which for males is typically attributed to representing some proxy for individual reliability is only significant for males, not females. There is evidence that earnings vary to a less significant degree by region in the public sector relative to the private sector[4]. This may also have implications for public policy[5].

Turning to variation in the government status differential according to union membership, the estimated differentials do not appear to vary on the basis of this characteristic. The variation between public and private sector returns to education is also considered by the addition of interaction terms to a single equation model for earnings between education and public sector participation. The same point as that from Table 1 emerges in Table 3 which reports the associated estimation results for the interaction terms. Returns to educational qualifications relative to the omitted category of no qualifications, are generally higher in the public sector for women. For men there is generally no differential, with the exception of lower returns to a first or higher degree in the public sector. When focusing upon the returns to education, controlling for occupation may be ill-advised. As we

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3. The numbers of 'non-whites' in the private sector sample are equal to 54 males and 20 females.

4 The point estimates on the region dummies imply, inter alia, a 32 % (38 %) wage gap for males (females) working in London relative to the West Midlands in the private sector compared to one of 22 % (25 %) in the public sector.

5 It may well be the case that public sector wages also vary less over the economic cycle (e.g. Elliott and Duffus, 1996). Given the existence of a downturn in economic activity during 1991, this may imply that any estimated differential is an overestimate of that pertaining over the cycle as a whole.

observe in Table 3 however, omitting the occupation dummies gives rise to precisely the same pattern of results.

Alongside estimation of the differential associated with a particular characteristic, it is also informative to provide a (joint) test of whether particular characteristics are rewarded equally across the sectors in question. This will also indicate whether modelling wage determination in these sectors is more appropriate by employing a seprate equation approach. In Table 4, we report the results of tests of the equality of the coefficient vectors across a number of different labour market sectors. Wald tests (Table 4A) indicate that in each case, at the 5 % level, we reject the null hypothesis. At the 1 % level we are unable to reject the null of equality of coefficients for union members and non members in the public sector. It is known however, that these Wald tests, whilst allowing for unequal disturbance variances, tend to too frequently reject the null hypothesis, particularly in small samples. As a consideration of this potential issue, we present the results of Kobayashi's (1986) bounds test for the equality of coefficient vectors (Table 4B). The same pattern of results is observed as that noted previously for the Wald tests. The null hypothesis is rejected in each case with the exception of the union member - non member case within the public sector which, at the 5 % level lies in the inconclusive region of the bounds test.

We next go on to consider variation in the government differential according to the individual occupation, region and industrial sector. The differentials for these different categories are considered individually, being evaluated in turn for the particular category with the further set of characteristics being set at their mean public sector values. Considering variation by occupation first, in Table 5 we observe evidence of a significantly negative public sector pay penalty for male professional employees. By region, the government differential for males is significantly negative for employees located in the North East with evidence of smaller government differentials for women residing in the South of England. In terms of evaluating the government differential by industry sector, it is clear that our previous set of results for the government differential for males and females are being driven by the differential in the 'Other Services' sector which accounts for a very large proportion of public sector employment by industry group. Hence, estimated differentials for other industry groups tend to be rather poorly-determined. It may also be necessary to acknowledge the possibility of some misclassification of industry affiliation (see e.g. Krueger and Summers, 1988). There exists one possible source of concern in evaluating the government differential for the 'Other Services' industry sector. There is the possibility of significant heterogeneity within this residual category which may be related to government status. Indeed, on examining the sample distributions across industries at the two-digit level, we observe that whilst 53 % of public sector male employees in Other Services are employed in Public Administration, there are no male private sector employees in this two-digit industry. Similarly, for the female samples, as one would expect, there are no women in the private sector employed in Public Administration, whereas 26 % of public sector women in Other Services are employed in this industry category.

An analysis of wage determination in the public sector also provides a context for considering how the differential associated with gender varies between the public and private sectors. On conducting an Oaxaca (1973) decomposition of the wage differential, the results indicate a significantly larger gender wage differential in the private relative to the public sector. The gender-based differential is estimated at approximately 25 % in the private sector and at 8 % in the public sector. Moreover, this latter estimate is insignificantly different from zero at conventional levels. When estimating the gender differential at female rather than male mean characteristics, the estimated differential (standard error) becomes 0.099 (0.032) in the public sector and is therefore statistically significant. This compares to an estimate in the private sector of 0.192 (0.026), estimated at female sector means. This finding of a smaller gender differential in the public sector has laso been obtained in U.S. studies (see Ehrenberg and Schwartz, 1986, pp. 1252-1255) and studies for Sweden (e.g. Zetterberg, 1992) and Denmark (Rosholm and Smith, 1996) and has been interpreted in the manner of evidence for less gender-based discrimination in the public sector.

A similar consideration of variation in the union membership differential suggests that this is larger in the private sector, estimated at 10 % to 12 % in this sector of the economy. The evidence from Table 1 indicated that the union wage differential in the public sector appears to be associated with coverage rather than membership to a greater extent than in the private sector. However, given that such a small proportion of workplaces in the public sector do not recognise a trade union, we are not in a position to estimate separate equations by coverage within the public sector.

We now turn to a quantile regression analysis of wage determination in the public and private sectors of the British economy using BHPS 1991, estimating our earnings equations separately by gender.

For males, there is some evidence of variation by quantile in the government status differentials with these becoming negative at high quantiles, particularly in the case of the National Health Service / State Higher Education and local government sectors. For women, these government status differentials show further variation. Whilst remaining significantly positive for each estimated point in the conditional wage distribution, they appear greater in magnitude at lower quantiles. However, at this point we must note that a similar pattern in variation i.e. larger government differentials at lower quantiles, would be anticipated on the basis of the smaller residual variance the public sector. One may assess the extent to which differences in residual variances are likely to account for these results by reference to a result presented in Chamberlain (1994). Thus if we let the conditional distribution of the log wage in the public sector be $N(X'\beta_A, \sigma_A^2)$ and in the private sector $N(X'\beta_B, \sigma_B^2)$ then the wage differential at the qth quantile is given by $X'(\beta_A - \beta_B) + (\sigma_A - \sigma_B)q$. Thus for $\sigma_A < \sigma_B$, this predicts that that the estimated differential is larger at lower q. We have observed from our previous regression results that the equation standard error is indeed smaller in the public sector for both males and females. Following Chamberlain (1994) (see also Poterba and Reubens, 1994), we substitute the least squares estimates into the above expression which leads us to anticipate the differential to vary by 0.037 for males and 0.022 for females in moving from the 0.1 to 0.9 quantile - compared to our derived estimates of approximately 0.2 for males and 0.1 for females. In practice therefore, this suggestion would not appear to account for our pattern of results.

Consideration of the additional estimated wage differentials in these quantile wage equations is also worthy of note. We focus upon the differentials associated with education, workplace size and union presence. Regarding the returns to education qualifications, there is little suggestion that these display any great variation for either males or females across the quantiles considered with the main exception being the declining returns to A-levels for women at higher quantiles. The workplace size differential, particularly in terms of the differential between the smallest and largest categories appears to be greater at the lowest quantiles. The union wage differential, for both males and females appears to follow a similar pattern, also being larger at lower quantiles of the wage distribution. This is a result also found by Chamberlain (1994) on U.S. C.P.S. data, although Chamberlain's results appeared to indicate that this pattern could be accounted for by differences in the residual variance in the union and non-union sectors. For the case of Great Britain, this issue is worthy of further attention beyond that presented in the present paper.

We have noted that the conditional wage distribution is less dispersed for both males and females in the public sector. In terms of the unconditional log wage distributions for these sectors we can again note that as one would tend to expect, there exists greater wage disperion within the private sector relative to that in the public sector. Thus for males, the coefficient of variation in the public sector of 0.251 compares to a value of 0.321 in the private sector. An even greater dispersion for females is evident with the coefficient of variation being equal to 0.256 in the public sector and 0.351 in the private sector.

A further point we wish to make refers to the results of sensitivity checks of our estimation results in terms of the inclusion or exclusion of particular controls. The results prove to be insensitive to the precise specification and as such display strong signs of being robust - with one notable exception. In the estimating equation for women, the estimated premium for employment in the public sector hinges upon the inclusion of controls for industry. Thus the large positive wage premia for women in the public sector is very much a within industry differential. There would however appear to be at least two important reasons for retaining these industry controls. First, earnings have been found to vary significantly according to industry even after controlling for a range of human capital and demographic characteristics (Hildreth, 1995; Benito, 1997). Thus if we wish to consider a wage differential associated with public sector affiliation per se, we should ensure that we are not merely picking up what is essentially an industry effect. Second, and relatedly, it is clear that public and private sector activities are not evenly distributed across industries. Thus activities for the public sector are to a significant degree based in the relatively low-paying service sector : 84% of employees in the public sector in our sample are to be found in the 'Other Services' sector compared to 6 % of private sector employees. This would therefore appear to account for the fact that failure to control for industry is associated with a much reduced estimated public sector wage effect, at least for women. Both Hildreth (1995) and Benito (1997) estimate a 10% pay penalty in the private sector of working in this industry relative to the 'average' industry. Nevertheless, one might wish to argue that it is in the nature of public services to be specialised in particular activities (e.g. public goods and merit goods) such that, as a consequence, public sector employment is concentrated in particular sectors. On such an argument, the desirability of controlling for industry affiliation may seem less clear. For comparison purposes we report the results of the government wage differential by gender when estimated without industry controls in Table 7. It is clear that this has a marked impact upon the nature of our results for women. The overall government differential for women is now insignificantly different from zero with a point estimate (standard error) of 0.035 (0.038). There is also variation around the average in terms of employment in different public sector activities. Relative to employment in local government, there is an estimated public sector pay penalty of working in the N.H.S. or State Higher Education sectors of 12 %. One should be clear that the inclusion or not of the industry dummies implies a different conceptual experiment in the differential being estimated. This distinction in the conceptual experiment we are attempting to consider, according to the inclusion or otherwise of the industry dummies, comes to the fore in the two contexts in which our results have special relevance. First, privatisation naturally gives rise to a case of switching from public to private sector status whilst holding constant other factors, including industrial activity. Our results imply the prediction that the wages of women will fall markedly following privatisation. Second, the debate concerning public sector pay comparability is made with reference to the level of pay in the private sector as a whole, controlling for the standard individual and job characteristics. The major British study of pay comparability between the public and private sectors is that of the Clegg Commission Report (1980). The pay comparability exercises carried out by the Commission essentially attempted to define comparator groups in terms of occupation, education and experience levels. In this context, a case can be made therefore, for omitting the industry controls. On the basis of our associated set of results, the suggestion emerges that male employees experience a 13 % pay penalty of employment in the National Health Service / Higher Education sectors relative to the private sector, with some indication of a pay penalty also being experienced by women employees in this sector. Female civil service or central government employees appear to enjoy a pay premium of over 14 % compared to the private sector. In general, the results also serve to highlight the importance of clarity in the debate concerning public sector pay comparability and the definition of the comparator group which one has in mind.

A final point we must acknowledge is that we have not allowed for the possibility that assignment between public and private sectors is non-random, a point which applies equally to the estimation of any inter-sectoral wage differential associated with a characteristic that is not purely exogenous. Estimation of such selection models allowing for non-random selection rests upon one's ability to identify factors which influence the probability of being employed in a particular sector but may be validly excluded from a wage equation. As in Poterba and

Reubens (1994), we have not adopted this approach owing to our inability to find such variables which may be convincingly excluded from the wage equations. This may however represent a natural direction for further research. The paper by Rees and Shah (1995), whilst claiming to allow for non-random selection does not employ any identifying variables in the selector equation. Thus the analysis attempts to achieve identification by virtue of the non-linearities of the probit model for sector attachment. Achieving identification via such functional form assumptions is highly questionable. Gyourko and Tracy (1988) also attempt to allow for endogenous selection. In this case, Education, as a disjointed spline function, and dummies for junior and senior worker status are employed as instruments for sector attachment. Imposing zero restrictions on educational attainment is clearly questionable according to human capital theory, whilst occupational effects are standard in analysis of wage determination.

4 Concluding Remarks

The paper has considered the determination of earnings in both the public and private sectors of the British economy, employing cross-sectional data from the British Household Panel Survey of 1991. Estimation of the differential associated with employment in the public sector alongside variation in estimated wage premia between the public and private sectors allowed us to document several new results regarding wage determination in the British labour market. Our results may be summarised as follows :

- For women, and controlling for a range of individual and job characteristics - including industry - there is evidence of a substantial wage premium associated with employment in the public sector. The mean differential for women is estimated at 32 % when evaluated at the mean characteristics of female public sector employees. This differential does appear to vary significantly between employment in different categories within the public sector in that women in the N.H.S. or State Higher Education sectors experience an estimated pay penalty of 13 % relative to local government or local service employees.
- For men, there was no significant mean government wage differential. There was however some evidence of a negative wage differential for those public sector male employees employed in the National Health Service or State Higher Education sector.

- The gender wage differential is significantly smaller in the public sector relative to the private sector. The gender differential is estimated at between 8 % and 10 % in the public sector, compared to an estimate of 20 % to 25 % in the private sector.
- The union membership wage differential is insignificantly different from zero in the public sector and is estimated at approximately 10 % in the private sector. The union differential for males in the public sector appears to be more particularly associated with union coverage, with 97 % of employees being employed at places of work which recognise a trade union.
- The returns to education qualifications are significantly higher for women in the public sector.
- There is evidence of a smaller differential associated with workplace size. In the public sector, wages vary less significantly by region than in the private sector.
- The Government differentials for males appeared to be increasingly negative for males at relatively high quantiles of the conditional wage distribution, particularly in terms of the National Health Service / State Higher Education differential. For women, the positive government wage differentials are estimated as being larger at lower quantiles of the distribution.
- Evidence was found for greater union and workplace size wage effects at lower quantiles of the wage distribution.
- Estimated government differentials for women were sensitive to the inclusion of controls for industry affiliation. This is likely to reflect the fact that public sector employment tends to be concentrated in low-paying service sector jobs.

The observation of differentials which vary so markedly on the basis of gender naturally gives rise to a discussion regarding the presence of discrimination. In this context, our results would appear to indicate that there may exist significantly less gender-based discrimination in the public sector relative to the private sector. Nevertheless, we must remain sensitive to the suggestion that the estimated wage equations may not control sufficiently well for relevant wage-determining factors, in which case such a conclusion must be made with some caution. Nevertheless, such suggestions, perhaps based on an argument regarding the greater practice of attaching wages to jobs rather than individual workers in the public sector, appear to be consistent with evidence for other countries of a smaller gender differential in the public sector.

In order to derive further implications of the present analysis for the determination of pay for groups of public sector employees it would be desirable to consider separately, wage determination for distinct groups of occupations. This may be possible if we choose to pool successive waves of the British Household Panel Survey. Additional scope for future research is provided by the ongoing panel nature of the current dataset in the sense that it will be possible to attempt to control for omitted unobservable characteristics which may be related to both the wage and propensity to be employed in the public sector. The present results have nevertheless, served to suggest that there are significant differences to patterns of wage determination between the public and private sectors of the British labour market.

Table 1 : Public and Private Sector Wage Equations
Dependent Variable : log usual hourly wage
standard errors in parentheses

	Public sector		Private sector	
	male	female	male	female
Civil Service/Central Govnment	0.054 (0.048)	0.056 (0.055)		
Nationalised Industry	0.083 (0.091)	0.093 (0.201)		
Nat Health Serv/Higher Eductn	-0.098 (0.057)	-0.122 (0.045)		
.				
highest qualification obtained :				
Apprenticeship	-0.047 (0.124)	-	0.090 (0.057)	0.083 (0.260)
CSE Grades 2-5	0.226 (0.103)	-0.007 (0.172)	0.030 (0.045)	-0.004 (0.066)
Commercial Qualifications	0.376 (0.235)	0.310 (0.105)	0.193 (0.223)	0.013 (0.058)
GCE O-level	0.107 (0.065)	0.210 (0.076)	0.113 (0.030)	0.092 (0.041)
GCE A-level	0.164 (0.068)	0.323 (0.085)	0.176 (0.035)	0.120 (0.052)
Nursing	0.238 (0.160)	0.509 (0.093)	0.114 (0.282)	0.221 (0.109)
Other Higher Qualification	0.269 (0.069)	0.396 (0.078)	0.249 (0.034)	0.206 (0.057)
Teaching	0.303 (0.104)	0.447 (0.093)	0.136 (0.280)	0.149 (0.148)
First Degree / Higher Degree	0.366 (0.083)	0.500 (0.084)	0.449 (0.047)	0.397 (0.070)
experience	0.043 (0.006)	0.020 (0.006)	0.035 (0.003)	0.031 (0.004)
*experience^2	-0.085 (0.013)	-0.046 (0.013)	-0.061 (0.007)	-0.071 (0.010)
*tenure	0.030 (0.053)	0.017 (0.075)	0.082 (0.003)	0.097 (0.057)
**tenure^2	0.007 (0.014)	0.016 (0.030)	-0.022 (0.008)	-0.022 (0.019)
size : 25 to 99 employees	0.047 (0.057)	0.015 (0.044)	0.126 (0.027)	0.122 (0.149)
size : 100 to 499 employees	0.114 (0.055)	-0.016 (0.046)	0.129 (0.028)	0.149 (0.036)
size : 500 or more	0.104 (0.059)	0.111 (0.051)	0.217 (0.032)	0.217 (0.046)
union member X coverage	0.227 (0.098)	0.019 (0.094)	0.103 (0.025)	0.102 (0.035)
(1-union member) X coverage	0.211 (0.103)	-0.007 (0.098)	0.005 (0.030)	0.066 (0.040)
white	0.393 (0.102)	0.183 (0.073)	0.026 (0.049)	0.081 (0.082)
married	0.172 (0.043)	0.047 (0.037)	0.106 (0.026)	0.014 (0.029)
managerial duties	0.067 (0.039)	0.147 (0.037)	0.119 (0.024)	0.138 (0.031)
poor health	-0.037 (0.107)	0.092 (0.072)	0.010 (0.054)	-0.092 (0.054)
Additional controls :				
occupation dummies	yes (8)	yes (7)	yes (8)	yes (8)
industry dummies	yes (7)	yes (5)	yes (8)	yes (8)
region dummies	yes (10)	yes (10)	yes (10)	yes (10)
constant	0.417 (0.220)	1.070 (0.355)	0.475 (0.088)	0.433 (0.173)
F-test occupation dummies	F(8,367)=3.77	F(7,405)=5.69	F(8,1479)=15.16	F(8,770)=6.01
F-test industry dummies	F(7,367)=1.54	F(5,405)=1.47	F(8,1479)=7.89	F(8,770)=8.80
F-test region dummies	F(10,367)=4.50	F(10,405)=3.98	F(10,1479)=10.07	F(10,770)=9.45
Root M.S.E.	0.323	0.323	0.369	0.351
Mean of dependent variable	1.854	1.712	1.672	1.379
R-squared	0.579	0.514	0.544	0.505
R-bar squared	0.522	0.459	0.529	0.474
sample size	418	452	1528	819

Notes to Table 1

1. sample is restricted to those individuals employed in either the public or private sectors, aged between 16 and 65 and working at least 30 hours per week.
2. Number of controls may vary between columns if zero cell size requires dropping of control variable.
3. * denotes coefficient and standard error multiplied by 100
   ** denotes coefficient and standard error multiplied by 1×10^4.

Table 2 : Variation in Government Differential		
Wage Differential		
Overall	0.111 (0.034)	
Estimated Coefficient on# :		
Civil Service / Central Government	0.054 (0.034)	
Nationalised Industry	0.042 (0.078)	
N. H.S. / State H. E.	-0.129 (0.035)	
	Male	Female
Mean	-0.010 (0.047)	0.278 (0.053)
Estimated Coefficient on :		
Civil Service / Central Government	0.054 (0.048)	0.056 (0.055)
Nationalised Industry	0.083 (0.091)	0.093 (0.201)
N. H.S. / State H. E.	-0.098 (0.057)	-0.122 (0.045)
	Union Member	Non-union member
Mean	0.161 (0.058)	0.117 (0.048)
Estimated Coefficient on :		
Civil Service / Central Government	0.036 (0.038)	0.094 (0.086)
Nationalised Industry	0.053 (0.085)	-0.177 (0.334)
N. H.S. / State H. E.	-0.144 (0.040)	-0.135 (0.078)

Notes to Table 2 :

1. Standard errors in parentheses (see Stewart, 1987).
2. Differentials evaluated at Public Sector Means
3. # Omitted category : employment in Local Government / Local Services.

Table 3 : Variation in Return to Educational Attainment Between Public and Private Sectors

	Males		Females	
	[occupation controls]	[no occupation controls]	[occupation controls]	[no occupation controls]
Apprenticeship	-0.134 0.136)	-0.072 (0.147)	-	-
CSE Grades 2-5	0.229 (0.105)	0.225 (0.117)	0.034 (0.179)	-0.150 (0.180)
Commercial Qualifications	0.247 (0.333)	0.170 (0.346)	0.329 (0.098)	0.249 (0.112)
GCE O-level	0.013 (0.052)	-0.022 (0.070)	0.218 (0.053)	0.166 (0.074)
GCE A-level	0.012 (0.059)	-0.017 (0.075)	0.315 (0.074)	0.247 (0.091)
Nursing	0.006 (0.306)	0.035 (0.320)	0.288 (0.116)	0.235 (0.130)
Other Higher Qualification	0.008 (0.052)	-0.011 (0.070)	0.299 (0.067)	0.208 (0.086)
Teaching	0.101 (0.286)	0.070 (0.299)	0.418 (0.161)	0.561 (0.166)
First / Higher Degree	-0.183 (0.061)	-0.164 (0.076)	0.189 (0.074)	0.166 (0.089)
Root M.S.E.	0.363	0.374	0.348	0.355
Mean of dependent variable	1.711	1.711	1.497	1.497
R-squared	0.543	0.511	0.527	0.503
R-bar squared	0.529	0.498	0.505	0.483
sample size	1946	1946	1271	1271

Notes to Table 3 :

1. Table 3 reports the results for the interaction terms between public sector affiliation and educational qualifications; for additional explanatory variables, see Table 1.
2. There are no females with an apprenticeship in the public sector.

Table 4A : Wald Tests of Equality of Coefficients Across Sectors	
Public Sector Males and Females : χ^2 (47) = 98.960 ; [p=0.000] Union members & non-members : χ^2 (50) = 71.655 ; [p=0.024]	Private Sector Males and Females : χ^2 (49) = 247.044 ; [p=0.000] Union members & non-members : χ^2 (49) = 81.287 ; [p=0.003]
Males Public & Private : χ^2 (48) = 92.144 ; [p=0.000]	Females Public & Private : χ^2 (44) = 122.708 ; [p=0.000]
Union Members Public & Private : χ^2 (47) = 76.222 ; [p=0.005]	Non-Union members Public & Private : χ^2 (48) = 77.002 ; [p=0.005]

Table 4B : Bounds Tests of Equality of Coefficients Across Sectors	
Public Sector Males and Females : F(47, 371) = 2.106; [p=0.000] F(47, 776) = 2.106 ; [p=0.000] Union members & non-members : F(50,138) = 1.433 ; [p=0.053] F(50, 770) = 1.433 ; [p=0.029]	Private Sector Males and Females : F(49, 770) = 5.042 ; [p=0.000] F(49, 2249) = 5.042 ; [p=0.000] Union members & non-members : F(49, 679) = 1.659 ; [p=0.004] F(49, 2249) = 1.659 ; [p=0.003]
Males Public & Private : F(48, 370) = 1.920 ; [p=0.000] F(48, 1850) = 1.920 ; [p=0.000]	Females Public & Private : F(44, 408) = 2.789 ; [p=0.004] F(44, 1183) = 2.789 ; [p=0.003]
Union Members Public & Private : F(47, 635) = 1.622 ; [p=0.007] F(47, 1316) = 1.622 ; [p=0.005]	Non-Union members Public & Private : F(48, 140) = 1.604 ; [p=0.018] F(48, 1711) = 1.604 ; [p=0.006]

Notes to Tables 4A and 4B :

1. Table 4A reports the results of Wald tests of Equality of coefficients (including the constant term) on the common variables in the relevant sectors; see Greene (1990, p. 215).
2. Table 4B reports the results of Kobayashi's (1986) Bounds Test of the Equality of Sets of Coefficients. The former test statistic value is considered against the Upper Critical Value of the bound with the latter figure being with respect to the Lower Critical Value.

Table 5 : Variation in Government Differential by Occupation, Region and Industry

	Males		Females	
Occupation	Wage Differential	No. In Public Sector	Wage Differential	No. In Public Sector
Managers & Admin.	-0.031 (0.074)	49	0.478 (0.092)	37
Professional	-0.187 (0.074)	82	0.317 (0.097)	117
Assoc. Professional & Technical	0.009 (0.076)	49	0.164 (0.074)	112
Clerical & Secretarial	-0.012 (0.074)	49	0.257 (0.070)	106
Craft & related	-0.075 (0.075)	44	0.492 (0.176)	4
Personal & Protective Service	omitted group	74	omitted group	56
Sales	0.032 (0.380)	1	0.186 (0.387)	1
Plant & Machine Operatives	-0.060 (0.088)	27	-	0
Other	0.037 (0.089)	43	0.105 (0.116)	19
Region				
London	-0.014 (0.067)	59	0.204 (0.075)	56
South West	-0.005 (0.062)	68	0.146 (0.072)	56
Rest of South	0.005 (0.080)	35	0.170 (0.101)	20
East Anglia	-0.194 (0.138)	8	0.165 (0.126)	12
East Midlands	0.028 (0.087)	30	0.378 (0.094)	28
West Midlands	omitted group	39	omitted group	47
North West	0.026 (0.075)	35	0.330 (0.075)	53
Yorkshire	0.036 (0.073)	45	0.314 (0.081)	48
North East	-0.202 (0.086)	30	0.286 (0.092)	45
Wales	-0.021 (0.095)	25	0.203 (0.099)	34
Scotland	-0.059 (0.080)	44	0.443 (0.086)	53
Industry				
Energy & Water Supply	0.026 (0.110)	20	-	0
Extractn & Manuf. of Minerals	0.288 (0.213)	3	0.118 (0.408)	1
Metal Gds., Engnrng, Vehicles	0.029 (0.146)	6	0.122 (0.232)	2
Other Manufacturing	-0.124 (0.275)	2	-	0
Construction	omitted group	24	omitted group	2
Distribution, Catering, Repairs	-	0	-0.136 (0.242)	2
Transport & Communications	-0.044 (0.093)	52	0.155 (0.149)	7
Banking, Finance and Business	-0.027 (0.101)	14	-	0
Other Services	-0.011 (0.064)	297	0.284 (0.055)	438

Table 6 : Wage Premia in the Public and Private Sectors

Wage Differential	Public Sector		Private Sector	
Estimated by Separate Equations :				
Union Membership Wage Differential	-0.019 (0.051)		0.092 (0.027)	
Gender Differential	0.077 (0.052)		0.230 (0.027)	
Estimated as Additive Dummy :				
Covered Member	0.141 (0.066)		0.103 (0.021)	
Covered Non-Member	0.110 (0.070)		0.026 (0.024)	
Gender	0.111 (0.027)		0.201 (0.019)	
	Male	Female	Male	Female
Workplace Size :				
25 to 99 employees	0.047 (0.057)	0.015 (0.044)	0.126 (0.027)	0.122 (0.034)
100 to 499 employees	0.114 (0.055)	-0.016 (0.046)	0.129 (0.028)	0.149 (0.036)
500 or more	0.104 (0.059)	0.111 (0.051)	0.217 (0.032)	0.217 (0.046)
Covered Member	0.227 (0.098)	0.019 (0.094)	0.103 (0.025)	0.102 (0.035)
Covered Non-member	0.211 (0.103)	-0.007 (0.098)	0.005 (0.030)	0.066 (0.040)

Notes to Table 6 :

1. Differentials estimated by separate equations are evaluated at Sector A means where :
Union Wage Differential : Sector A=union member;
Gender Differential : Sector A=male .

Table 7 : Government Differentials With and Without Controls for Industry		
	Males	Females
Including Industry Controls		
Mean Differential	-0.010 (0.047)	0.278 (0.053)
Differential for :		
Civil Service / Central Gov.	0.033 (0.057)	0.365 (0.069)
Nationalised Industry	0.061 (0.089)	0.402 (0.202)
N.H.S./Higher Education	-0.119 (0.066)	0.187 (0.060)
Local Government	0.021 (0.052)	0.309 (0.057)
Excluding Industry Controls		
Mean Differential	-0.019 (0.027)	0.035 (0.038)
Differential for :		
Civil Service / Central Gov.	0.029 (0.041)	0.141 (0.057)
Nationalised Industry	0.030 (0.053)	0.292 (0.147)
N.H.S./Higher Education	-0.129 (0.052)	-0.060 (0.047)
Local Government	-0.025 (0.034)	0.061 (0.043)
Estimated Coefficient On# :		
Civil Service / Central Gov.	0.054 (0.045)	0.081 (0.053)
Nationalised Industry	0.055 (0.056)	0.232 (0.146)
N.H.S./Higher Education	-0.103 (0.056)	-0.121 (0.045)

Notes to Table 7

1. Regressions as in Table 1 with exclusion of industry control variables.
2. Differentials evaluated at Public Sector mean characteristics for males and females respectively
3. # denotes omitted group : Local Government / Local Services

Table 8 : Quantile Regressions of Wage Equations

Including Industry Controls
MALES

Percentile (from lower tail of distribution) :

	10^{th}	25^{th}	50^{th}	75^{th}	90^{th}
Central Government	0.103 (0.092)	0.079 (0.043)	0.041 (0.046)	-0.032 (0.059)	-0.088 (0.085)
local government	0.109 (0.083)	-0.005 (0.039)	0.021 (0.040)	-0.032 (0.052)	-0.121 (0.068)
N. H. S. / H.E.	-0.003 (0.111)	-0.188 (0.055)	-0.136 (0.057)	-0.180 (0.071)	-0.222 (0.097)
Nationalised Industry	0.089 (0.093)	0.047 (0.047)	0.069 (0.047)	0.069 (0.059)	-0.009 (0.079)
<u>highest qualification obtained :</u>					
Apprenticeship	0.149 (0.099)	0.130 (0.046)	0.017 (0.047)	0.057 (0.058)	0.083 (0.078)
CSE Grades 2-5	-0.051 (0.070)	0.035 (0.035)	0.093 (0.037)	0.101 (0.047)	0.103 (0.059)
Commercial	-0.161 (0.112)	0.297 (0.124)	0.313 (0.135)	0.461 (0.166)	0.415 (0.094)
GCE O-level	0.070 (0.052)	0.067 (0.025)	0.116 (0.025)	0.112 (0.033)	0.090 (0.043)
GCE A-level	0.158 (0.059)	0.173 (0.028)	0.176 (0.029)	0.169 (0.037)	0.173 (0.050)
Nursing	0.461 (0.225)	0.227 (0.097)	0.115 (0.128)	0.290 (0.148)	0.152 (0.121)
Other Higher	0.274 (0.064)	0.248 (0.029)	0.261 (0.028)	0.290 (0.035)	0.279 (0.046)
Teaching	0.334 (0.091)	0.291 (0.081)	0.177 (0.078)	0.268 (0.090)	0.452 (0.111)
First / Hghr Degree	0.422 (0.084)	0.389 (0.038)	0.431 (0.037)	0.454 (0.047)	0.478 (0.061)
experience	0.038 (0.005)	0.032 (0.003)	0.031 (0.003)	0.036 (0.003)	0.038 (0.004)
*experience^2	-0.073 (0.011)	-0.059 (0.006)	-0.053 (0.006)	-0.062 (0.007)	-0.071 (0.009)
*tenure	0.100 (0.045)	0.066 (0.024)	0.070 (0.025)	0.069 (0.030)	0.100 (0.043)
**tenure^2	-0.022 (0.010)	-0.011 (0.006)	-0.016 (0.007)	-0.020 (0.008)	-0.014 (0.012)
size : 25 to 99 employees	0.151 (0.044)	0.111 (0.021)	0.074 (0.022)	0.063 (0.028)	0.066 (0.039)
size : 100 to 499 employees	0.096 (0.046)	0.118 (0.022)	0.111 (0.023)	0.122 (0.029)	0.102 (0.038)
size : 500 or more	0.236 (0.053)	0.199 (0.025)	0.155 (0.026)	0.167 (0.033)	0.165 (0.044)
union member X coverage	0.162 (0.045)	0.108 (0.021)	0.075 (0.021)	0.105 (0.027)	0.023 (0.037)
(1-union member) X coverage	0.135 (0.051)	0.042 (0.024)	0.035 (0.025)	0.020 (0.030)	-0.093 (0.041)
white	0.284 (0.089)	0.091 (0.043)	0.098 (0.044)	0.067 (0.054)	0.074 (0.066)
married	0.211 (0.036)	0.134 (0.020)	0.092 (0.021)	0.073 (0.026)	0.053 (0.033)
managerial duties	0.109 (0.038)	0.125 (0.018)	0.115 (0.019)	0.103 (0.024)	0.137 (0.030)
poor health	-0.124 (0.070)	0.032 (0.042)	0.013 (0.042)	-0.012 (0.057)	-0.024 (0.075)
<u>Additional controls</u>					
occupation dumms	yes (8)	yes (8)	yes (8)	yes (8)	yes (8)
industry dummies	yes (8)	yes (8)	yes (8)	yes (8)	yes (8)
region dummies	yes (10)	yes (10)	yes (10)	yes (10)	yes (10)
constant	-0.155 (0.131)	0.441 (0.070)	0.674 (0.071)	0.875 (0.090)	1.256 (0.114)
F-test : occupation	F(8,1893)=2.78	F(8,1893)=15.29	F(8,1893)=17.10	F(8,1893)=12.96	F(8,1893)=12.96
F-test : industry	F(8,1893)=3.53	F(8,1893)=10.74	F(8,1893)=12.81	F(8,1893)=5.82	F(8,1893)=12.96
F-test : region	F(10,1893)=7.95	F(10,1893)=14.98	F(10,1893)=12.49	F(10,1893)=10.77	F(8,1893)=12.96
pseudo R-squared	0.326	0.323	0.348	0.359	0.367
sample size	1946	1946	1946	1946	1946

Table 9 : Quantile Regressions of Wage Equations

Including Industry Controls
FEMALES

Percentile (from lower tail of distribution) :

	10^{th}	25^{th}	50^{th}	75^{th}	90^{th}
Central Government	0.300 (0.107)	0.409 (0.047)	0.320 (0.087)	0.262 (0.056)	0.180 (0.067)
local government	0.343 (0.096)	0.376 (0.036)	0.312 (0.071)	0.218 (0.051)	0.199 (0.054)
N. H. S. / H.E.	0.343 (0.096)	0.197 (0.039)	0.225 (0.074)	0.160 (0.048)	0.187 (0.054)
Nationalised Industry	0.222 (0.105)	0.193 (0.085)	0.130 (0.173)	0.052 (0.119)	0.120 (0.072)
.					
<u>highest qualification obtained :</u>					
Apprenticeship	0.299 (0.142)	-0.038 (0.077)	-0.345 (0.233)	0.164 (0.116)	0.120 (0.097)
CSE Grades 2-5	0.092 (0.107)	0.018 (0.041)	-0.035 (0.083)	0.005 (0.057)	0.001 (0.072)
Commercial	0.124 (0.092)	0.112 (0.037)	0.060 (0.068)	0.037 (0.047)	0.021 (0.055)
GCE O-level	0.127 (0.066)	0.158 (0.026)	0.118 (0.048)	0.119 (0.033)	0.053 (0.043)
GCE A-level	0.207 (0.086)	0.236 (0.033)	0.165 (0.060)	0.148 (0.040)	0.042 (0.053)
Nursing	0.370 (0.134)	0.318 (0.051)	0.333 (0.086)	0.418 (0.059)	0.284 (0.063)
Other Higher	0.302 (0.089)	0.303 (0.034)	0.268 (0.061)	0.275 (0.041)	0.218 (0.048)
Teaching	0.464 (0.140)	0.310 (0.055)	0.297 (0.092)	0.408 (0.062)	0.360 (0.076)
First / Hghr Degree	0.425 (0.101)	0.373 (0.038)	0.383 (0.071)	0.457 (0.049)	0.387 (0.061)
experience	0.020 (0.007)	0.022 (0.002)	0.026 (0.005)	0.030 (0.003)	0.037 (0.004)
*experience^2	-0.046 (0.015)	-0.047 (0.006)	-0.057 (0.011)	-0.063 (0.008)	-0.078 (0.010)
*tenure	0.186 (0.070)	0.082 (0.030)	0.084 (0.058)	0.038 (0.045)	0.010 (0.067)
**tenure^2	-0.060 (0.021)	-0.011 (0.010)	-0.009 (0.020)	-0.005 (0.017)	0.008 (0.027)
size : 25 to 99 employees	0.128 (0.046)	0.096 (0.019)	0.053 (0.037)	0.048 (0.026)	0.098 (0.033)
size : 100 to 499 employees	0.136 (0.050)	0.100 (0.020)	0.035 (0.039)	0.049 (0.027)	0.075 (0.035)
size : 500 or more	0.253 (0.057)	0.189 (0.024)	0.135 (0.047)	0.116 (0.033)	0.142 (0.043)
union member X coverage	0.104 (0.050)	0.133 (0.021)	0.070 (0.041)	0.037 (0.029)	0.026 (0.035)
(1-union member) X coverage	0.113 (0.055)	0.043 (0.022)	0.060 (0.045)	0.043 (0.032)	0.050 (0.041)
white	0.110 (0.102)	0.121 (0.038)	0.156 (0.075)	0.149 (0.051)	0.217 (0.071)
married	0.062 (0.041)	0.042 (0.016)	0.037 (0.031)	0.029 (0.022)	-0.007 (0.029)
managerial duties	0.135 (0.045)	0.114 (0.018)	0.124 (0.033)	0.118 (0.023)	0.088 (0.028)
poor health	-0.217 (0.086)	-0.025 (0.032)	-0.055 (0.060)	-0.034 (0.040)	-0.001 (0.058)
<u>Additional controls</u>					
occupation dumms	yes (8)	yes (8)	yes (8)	yes (8)	yes (8)
industry dummies	yes (8)	yes (8)	yes (8)	yes (8)	yes (8)
region dummies	yes (10)	yes (10)	yes (10)	yes (10)	yes (10)
constant	-0.465 (0.174)	0.352 (0.097)	0.519 (0.195)	0.828 (0.112)	0.904 (0.182)
F-test : occupation	F(8,1218)=3.78	F(8,1218)=15.51	F(8,1218)=5.21	F(8,1218)=10.06	F(8,1218)=9.88
F-test : industry	F(8,1218)=13.21	F(8,1218)=19.93	F(8,1218)=6.32	F(8,1218)=13.96	F(8,1218)=9.93
F-test : region	F(10.1218)=3.43	F(10.1218)=16.09	F(10.1218)=5.94	F(10.1218)=11.39	F(10.1218)=8.77
pseudo R-squared	0.295	0.327	0.367	0.399	0.398
sample size	1271	1271	1271	1271	1271

Data Appendix

Table A.1 Descriptive Statistics

Table A.1: Summary Statistics

standard errors in parentheses where applicable

	Public sector		Private sector	
.	n=418 Male	n=452 Female	n=1528 Male	n=819 Female
log hourly wage	1.854 (0.466)	1.712 (0.438)	1.672 (0.537)	1.379 (0.484)
civil service / Central Gov.	0.248	0.146		
local gov / local services	0.453	0.506		
N. H. S. / Higher Educ	0.147	0.334		
Nationalised industry	0.150	0.015		
.				
highest qualification obtained :				
Apprenticeship	0.021	0.000	0.033	0.002
CSE Grades 2-5	0.034	0.010	0.066	0.054
Commercial Qualifications	0.005	0.043	0.002	0.075
GCE O-level	0.178	0.213	0.228	0.349
GCE A-level	0.142	0.087	0.151	0.124
Nursing	0.014	0.101	0.001	0.015
Other Higher Qualification	0.211	0.148	0.198	0.102
Teaching	0.042	0.096	0.001	0.008
First Degree / Higher Degree	0.195	0.203	0.086	0.068
potential experience (years)	20.242 (11.677)	18.439 (11.156)	18.347 (12.273)	15.626 (12.014)
tenure (months)	82.449 (91.389)	53.828 (63.200)	61.076 (77.379)	45.691 (60.907)
size : 25 to 99 employees	0.266	0.268	0.253	0.250
size : 100 to 499 employees	0.324	0.234	0.267	0.263
size : 500 or more	0.276	0.233	0.182	0.136
union member X coverage	0.784	0.747	0.317	0.212
(1-union member) X coverage	0.183	0.222	0.135	0.137
white	0.971	0.943	0.957	0.975
married or living as a couple	0.731	0.697	0.700	0.616
managerial duties	0.492	0.444	0.396	0.341
poor health	0.026	0.050	0.033	0.059

Table A.2 : Quantile Regressions of Wage Equations

MALES

Percentile (from lower tail of distribution) :

	10^{th}	25^{th}	50^{th}	75^{th}	90^{th}
Central Government	-0.044 (0.066)	0.042 (0.052)	0.017 (0.054)	-0.022 (0.055)	-0.102 (0.079)
local government	-0.070 (0.056)	-0.022 (0.044)	-0.001 (0.044)	-0.017 (0.045)	-0.031 (0.059)
N. H. S. / H.E.	-0.246 (0.075)	-0.190 (0.063)	-0.205 (0.069)	-0.145 (0.072)	-0.184 (0.107)
Nationalised Industry	0.074 (0.074)	0.021 (0.063)	-0.019 (0.065)	0.040 (0.069)	0.004 (0.098)
.					
highest qualification obtained :					
Apprenticeship	0.135 (0.083)	0.119 (0.066)	0.065 (0.069)	0.067 (0.072)	0.093 (0.099)
CSE Grades 2-5	0.020 (0.058)	-0.001 (0.052)	0.106 (0.055)	0.141 (0.057)	0.126 (0.077)
Commercial	-0.327 (0.090)	0.277 (0.175)	0.353 (0.197)	0.445 (0.205)	0.387 (0.112)
GCE O-level	0.031 (0.042)	0.074 (0.035)	0.125 (0.037)	0.117 (0.039)	0.127 (0.051)
GCE A-level	0.142 (0.050)	0.145 (0.040)	0.205 (0.042)	0.189 (0.044)	0.207 (0.060)
Nursing	0.442 (0.182)	0.185 (0.137)	0.103 (0.185)	0.237 (0.179)	0.218 (0.148)
Other Higher	0.242 (0.054)	0.241 (0.041)	0.307 (0.041)	0.296 (0.041)	0.353 (0.057)
Teaching	0.312 (0.138)	0.262 (0.111)	0.207 (0.111)	0.277 (0.111)	0.442 (0.137)
First / Hghr Degree	0.365 (0.071)	0.392 (0.053)	0.491 (0.054)	0.470 (0.056)	0.538 (0.078)
experience	0.041 (0.004)	0.031 (0.004)	0.031 (0.004)	0.033 (0.004)	0.039 (0.005)
*experience^2	-0.077 (0.009)	-0.055 (0.008)	-0.056 (0.008)	-0.056 (0.008)	-0.068 (0.011)
*tenure	0.076 (0.039)	0.100 (0.034)	0.071 (0.036)	0.043 (0.036)	0.127 (0.053)
**tenure^2	-0.017 (0.009)	-0.021 (0.009)	-0.009 (0.010)	-0.013 (0.009)	-0.026 (0.016)
size : 25 to 99 employees	0.188 (0.036)	0.104 (0.029)	0.109 (0.032)	0.054 (0.034)	0.105 (0.047)
size : 100 to 499 employees	0.149 (0.035)	0.107 (0.030)	0.147 (0.032)	0.139 (0.035)	0.089 (0.046)
size : 500 or more	0.307 (0.040)	0.200 (0.034)	0.196 (0.036)	0.182 (0.039)	0.156 (0.055)
union member X coverage	0.151 (0.037)	0.138 (0.029)	0.095 (0.030)	0.122 (0.033)	0.073 (0.043)
(1-union member) X coverage	0.080 (0.040)	0.066 (0.034)	0.048 (0.036)	0.021 (0.037)	-0.060 (0.048)
white	0.290 (0.071)	0.125 (0.060)	0.019 (0.064)	0.092 (0.066)	0.112 (0.091)
married	0.206 (0.029)	0.154 (0.028)	0.118 (0.030)	0.083 (0.031)	0.057 (0.042)
managerial duties	0.101 (0.031)	0.110 (0.026)	0.109 (0.027)	0.111 (0.029)	0.121 (0.038)
poor health	-0.051 (0.068)	-0.002 (0.059)	-0.021 (0.064)	-0.031 (0.068)	0.009 (0.092)
Additional controls					
occupation dumms	yes (8)	yes (8)	yes (8)	yes (8)	yes (8)
region dummies	yes (10)	yes (10)	yes (10)	yes (10)	yes (10)
constant	-0.214 (0.106)	0.409 (0.088)	0.672 (0.091)	0.897 (0.098)	1.045 (0.146)
F-test : occupation	F(8,1901)=5.94	F(8,1901)=10.04	F(8,1901)=9.12	F(8,1901)=10.22	F(8,1901)=6.15
F-test : region	F(10,1901)=11.44	F(10,1901)=8.35	F(10,1901)=5.92	F(10,1901)=7.22	F(10,1901)=4.60
pseudo R-squared	0.326	0.309	0.348	0.345	0.354
sample size	1946	1946	1946	1946	1946

Table A.3 : Quantile Regressions of Wage Equations

FEMALES

Percentile (from lower tail of distribution) :

	10^{th}	25^{th}	50^{th}	75^{th}	90^{th}
Central Government	0.145 (0.108)	0.082 (0.048)	0.096 (0.041)	0.069 (0.047)	-0.023 (0.056)
local government	0.140 (0.077)	0.076 (0.034)	0.078 (0.030)	0.016 (0.034)	-0.012 (0.051)
N. H. S. / H.E.	-0.093 (0.088)	-0.081 (0.041)	0.020 (0.030)	0.003 (0.036)	-0.058 (0.052)
Nationalised Industry	0.283 (0.115)	0.171 (0.121)	0.126 (0.104)	0.097 (0.111)	0.224 (0.071)
.					
highest qualification obtained :					
Apprenticeship	0.206 (0.148)	-0.108 (0.099)	-0.451 (0.136)	0.383 (0.102)	0.129 (0.098)
CSE Grades 2-5	0.067 (0.127)	0.083 (0.055)	-0.024 (0.048)	-0.062 (0.053)	0.038 (0.071)
Commercial	0.193 (0.109)	0.166 (0.049)	0.104 (0.040)	0.010 (0.044)	0.032 (0.058)
GCE O-level	0.183 (0.082)	0.193 (0.034)	0.144 (0.028)	0.099 (0.030)	0.049 (0.041)
GCE A-level	0.274 (0.104)	0.258 (0.043)	0.202 (0.036)	0.126 (0.038)	0.033 (0.049)
Nursing	0.424 (0.160)	0.279 (0.069)	0.308 (0.050)	0.336 (0.054)	0.298 (0.063)
Other Higher	0.325 (0.107)	0.317 (0.044)	0.315 (0.035)	0.283 (0.038)	0.223 (0.050)
Teaching	0.493 (0.164)	0.399 (0.070)	0.338 (0.054)	0.372 (0.058)	0.353 (0.077)
First / Hghr Degree	0.479 (0.118)	0.426 (0.051)	0.453 (0.042)	0.429 (0.046)	0.409 (0.061)
experience	0.021 (0.008)	0.018 (0.003)	0.027 (0.003)	0.032 (0.003)	0.039 (0.004)
*experience^2	-0.051 (0.019)	-0.037 (0.008)	-0.058 (0.007)	-0.071 (0.008)	-0.086 (0.011)
*tenure	0.24 (0.086)	0.147 (0.039)	0.092 (0.036)	0.052 (0.041)	0.040 (0.054)
**tenure^2	-0.076 (0.026)	-0.040 (0.013)	-0.015 (0.013)	-0.007 (0.016)	-0.003 (0.017)
size : 25 to 99 employees	0.160 (0.056)	0.073 (0.026)	0.038 (0.022)	0.063 (0.024)	0.107 (0.034)
size : 100 to 499 employees	0.169 (0.060)	0.110 (0.027)	0.060 (0.023)	0.071 (0.025)	0.102 (0.036)
size : 500 or more	0.314 (0.066)	0.184 (0.032)	0.138 (0.027)	0.131 (0.031)	0.167 (0.044)
union member X coverage	0.144 (0.057)	0.190 (0.027)	0.094 (0.024)	0.087 (0.027)	0.087 (0.039)
(1-union member) X coverage	0.065 (0.062)	0.103 (0.030)	0.068 (0.026)	0.083 (0.029)	0.094 (0.043)
white	0.098 (0.119)	0.085 (0.054)	0.166 (0.045)	0.207 (0.051)	0.178 (0.061)
married	0.038 (0.048)	0.070 (0.021)	0.047 (0.018)	0.018 (0.021)	0.003 (0.030)
managerial duties	0.162 (0.054)	0.102 (0.023)	0.104 (0.019)	0.101 (0.021)	0.073 (0.029)
poor health	-0.132 (0.099)	-0.043 (0.043)	-0.044 (0.035)	-0.069 (0.039)	-0.063 (0.054)
Additional controls					
occupation dumms	yes (8)	yes (8)	yes (8)	yes (8)	yes (8)
region dummies	yes (10)	yes (10)	yes (10)	yes (10)	yes (10)
constant	0.112 (0.187)	0.339 (0.082)	0.530 (0.065)	0.704 (0.072)	0.877 (0.093)
F-test : occupation	F(8,1226)=2.97	F(8,1226)=12.61	F(8,1226)=19.96	F(8,1226)=22.60	F(8,1226)=12.47
F-test : region	F(10,1226)=2.22	F(10,1226)=9.28	F(10,1226)=15.83	F(10,1226)=14.52	F(10,1226)=10.03
pseudo R-squared	0.272	0.305	0.337	0.362	0.361
sample size	1271	1271	1271	1271	1271

Chapter 8

Policy Implications of Efficiency Wage Theory

1 Introduction

Relevant to the efficient functioning of labour and product markets, efficiency wage theory produces a number of significant policy implications. In this Chapter we are concerned with making these policy implications clear, focusing on the supply-side of the economy.

The price of labour represents the most important market price in the economy. In part the importance of efficiency wage theory stems from its consideration of this fundamental issue but further, its emphasis upon the fact that levels of efficiency are not independent of wages. At a general level, a case can be made for arguing that as an economy matures an increasing emphasis is to be placed on the quality relative to the price of labour. However, in an environment of efficiency wages, the price of labour must be distinguished from the direct costs associated with its employment. Spillovers exist from levels of remuneration to levels of efficiency. The efficiency wage hypothesis suggests that these spillovers are strong.

Much of the debate concerning efficiency wage theory within macroeconomics has focused upon the neutrality of money. In the present Chapter we focus instead upon the supply-side implications of efficiency wage theory. Nevertheless, one should note the central role which the literature now attaches to real rigidities, for instance resulting from efficiency wages - alongside nominal rigitidies - in order to obtain a convincing money non-neutrality result (see Ball and Romer, 1990).

At a general level, efficiency wage theory is related to the argument concerning the aim of achieving a high wage - high productivity economy. Whilst efficiency wage theory predicts these two outcomes to be complementary at the micro level this may extend to the macro level. It is in the high value-added product markets where both the greatest growth potential lies and also where efficiency wage considerations are likely to be at their most strong. However, the implications of efficiency wage theory extend beyond such general suggestions and in this chapter we attempt to set out these implications in a number of central policy areas.

The rest of the chapter is organised as follows. Section 2 examines unemployment. Section 3 considers the anticipated effects of minimum wage legislation. This is followed in Section 4 by an analysis of the contribution of efficiency wage theory to our understanding of, and implications for, discrimination. Section 5 considers industrial policy-making. Section 6 concludes.

2 Unemployment

Unemployment is present in the efficiency wage model since the market-clearing wage is less than the efficiency wage. In response to an excess supply of labour to the firm, the firm finds it unprofitable to cut the wage or accept underbidding since at wages below the optimum, the elasticity of efficiency with respect to the wage rate exceeds unity : cutting wages harms efficiency to a degree which more than offsets the positive effect on profits associated with the fall in direct wage costs. This illustrates the fact that unemployment is involuntary - the unemployed are willing to work at the market rate but are unable to receive job offers at this wage rate.

Ideally, any model of unemployment should also be able to offer some insight into the persistence of unemployment in response to some shock. That efficiency wage theory is able to make a contribution here is suggested by Layard *et al.*, (1991; pp. 168-170). If efficiency is a function of the wage relative to some normative wage as in Akerlof (1982) where the latter is slow to adjust to what is feasible, then persistence may result. According to Layard *et al.*, (1991), 'This model seems to offer a powerful explanation of the early phases of high and persistent unemployment, and it is firmly based in the notion of the efficiency wage.'

Throughout, Layard *et al.*, (1991) argue that the effectiveness of job search of the unemployed is a crucial determinant of the dynamics of unemployment. This argument is centred on the role of unemployment in moderating the wage demands of those in work. As average durations rise however, unemployment becomes less effective in achieving this 'role'. Thus the argument centres on unemployment durations in influencing the behaviour of the *unemployed*. The mechanism is one of competition for jobs and resulting moderation of wage demands. However if, as Layard *et al* (1991) maintain, the long-term unemployed are less effective job seekers, then the anticipated cost of job loss associated with shirking may also be a decreasing function of the average duration of the currently unemployed. The newly unemployed will represent more attractive candidates for any openings which arise. The disciplining role of the unemployed in deterring shirking is a decreasing function of the average duration of unemployment spells and the no-shirking condition is a function of the number of long-term unemployed. Unemployment durations may therefore be an important influence upon the behaviour of insiders directly rather than merely indirectly through their effect upon outsiders themselves. Given that average durations rise following a negative shock, persistence in unemployment may also result from this mechanism.

A more formal model of the way in which persistence and hysteresis effects may develop within an efficiency wage framework is presented by Saint-Paul (1995), who considers a dynamic extension of the Shapiro and Stiglitz (1984) shirking model. In Saint-Paul's (1995) model it is future wages which determine effort levels. When future employment levels are expected to decline, currently employed individuals have a greater incentive to shirk, which necessitates a rise in future wages. This creates the incentive for firms to avoid employment fluctuations such that persistence results.

The presence of hysteresis effects in unemployment place a premium upon avoiding increases in unemployment in the first instance. It also indicates that there are higher returns in prioritising the re-employment of those demographic groups which are more likely to experience long-term unemployment, although this may involve a trade-off vis a vis equity considerations.

3 Minimum Wage Legislation

It has been with respect to their unemployment effects that most discussions of minimum wages are concerned. Textbook treatments of a competitive labour market unambiguously predicted a detrimental impact. Typically, this received some cursory qualification in terms of the possibility of a monopsonistic employer. This possibility was not however considered to be strong. Manning (1995) emphasises the fact that this prediction of competitive models is not robust. In particular, it is not robust to the consideration of an efficiency wage model. This is an important point since efficiency wage models are commonly viewed in terms of the real wage rate being too high which in turn prevents market-clearing. It might seem natural to then argue that in an environment of efficiency wages, the removal of additional impediments to market-clearing takes on even greater significance.

The following analysis, based on that by Manning (1995), makes clear the underlying argument. The first-order conditions which define an optimum under profit-maximisation may be represented by :

$$R_N(N,w) - w = 0 \quad (1)$$

$$R_w(N,w) - N = 0 \quad (2)$$

where the dependence of the revenue function R (.) upon the wage, w, as well as the level of employment, N, reflects the efficiency wage hypothesis. Equations 1 and 2 are clearly rather general. Total differentiation of (1) generates,

$$R_{NN}(.)dN + R_{Nw}(.)dw - dw = 0$$

which may be rearranged to find dN /dw, the employment effect of an exogenous change in w :

$$\frac{dN}{dw} = \frac{1 - R_{Nw}(.)}{R_{NN}(.)} \quad (3)$$

The direction of the anticipated employment effect is thus given by $\text{sgn}\left(\frac{dN}{dw}\right) = \text{sgn}(R_{Nw} - 1)$ since $R_{NN}(.) \langle 0$.

From (5) we observe that at the efficiency wage, $\frac{R_w}{N} = 1$, in which case it follows that $\text{sgn}\left(\frac{dN}{dw}\right) = \text{sgn}\left(NR_{Nw} - R_w\right)$. Given that an implication of efficiency wage theory is that $R_w \rangle 0$, the direction of the employment effect of an exogenous change in the wage upon turns on whether $\frac{N R_{N w}}{R_w} \rangle 1$.

Hence the anticipated employment effects of a minimum wage depends upon the value of this elasticity and whether it exceeds unity. Manning (1995) goes on to demonstrate that efficiency wage models can imply a value for this elasticity of greater than one. At this point it is also worth citing recent empirical research into the employment effects of minimum wages which tend to suggest these to be neutral (e.g. Dickens *et al.,* 1995; Machin and Manning, 1994), consistent with the efficiency wage approach.

4 Discrimination

According to competitive theory, 'tastes' for discrimination by either employers or co-workers will be eroded by product market competition. There is scarce empirical evidence to support this contention. In order to consider the consequences of efficiency wage theory for our understanding of, and policy towards, discrimination, we follow Bulow and Summers (1986). Efficiency wage theory predicts that the necessary wage required to prevent shirking is increasing in the (exogenous) rate at which worker turnover takes place. If employees are more likely to quit their jobs, this requires a higher wage in order to equilibrate the expected returns from non-shirking relative to shirking. It follows that those demographic groups which tend to have higher separation rates will have lower demands for their labour as a result. According to Bulow and Summers (1986), a stylised fact is that those groups which are considered to be victims of discrimination do have higher turnover rates[1]. In addition, regarding the male - female wage differential a noteworthy point is that marriage typically improves the labour market rewards of men whereas married women are increasingly disadvantaged compared to single (and married) men than are single women (Greenhalgh, 1980). This is easily reconciled with the Bulow-Summers

[1] Clearly, this must be over and above any difference in rates of turnover which may reflect victimisation.

model since marriage will tend to raise the labour force attachment of men but reduce that of women.

The model of Bulow and Summers (1986) is a variant on the efficiency wage model where the distinction lies in the analysis of two-sectors, one of which faces a shirking problem whilst the other sector does not - monitoring is able to obviate the need for efficiency wages. These might be viewed as corresponding to a primary and secondary segment respectively. In this context, Bulow and Summers (1986) are able to show that a number of policies present themselves as welfare-enhancing. Thus a tax rate on (say) male employment in the primary sector imposed to finance a subsidy of female primary sector employment is welfare-improving for low tax values since it increases total employment in the primary sector. The same holds true for affirmative action policies which specify a quota for the primary sector employment of the disadvantaged group.

The case of equal pay legislation is considered relevant by Manning (1996), both in its own right but also as providing a close approximation to an experiment which provides scope for testing between competing models of the labour market. The starting point for the analysis is the claim that the labour demand model is unable to explain rising employment shares of women alongside a reduction in the male-female wage differential. Examining industry-level wages over the period 1970-78, Manning (1996) argues that the results provide support for a monopsonistic view of the female labour market. Evidence in support of a positive relation between wages and employment is found and one which is weaker in more heavily unionised industries (the prediction associated with monopsony becoming less likely where unions have greater countervailing power). For males, the relation between wages and employment is typically insignificant.

5 Industrial Policy

A central implication of efficiency wage theory is that employed workers earn rents. The law of supply and demand is repealed and replaced by rationing of available jobs (Stiglitz, 1987).

These rents are likely to exist between industries in the way that much of the efficiency wage empirical literature has suggested (e.g. Krueger and Summers, 1988) and neither reflect compensation for inferior working conditions or rewards to human capital. There are good jobs and bad jobs according to the degree to which conditions facilitate efficiency wage payments. Accompanying these higher wages are above average levels of productivity. In this way, marginal productivities are no longer equalised across sectors. Bulow and Summers (1986) also show that these effects are extended where the model is of a (small) open economy. In this case, the elasticity of product demand becomes infinite and no longer restricts the gains associated with increases in the employment and output of the primary sector. The policy of encouraging high value added sectors is essentially one of attempting to capture worker rents. The evidence of Katz and Summers (1989) is that these worker rents are potentially very large.

The argument therefore provides support for the view that policy should aim to encourage the growth of high wage - high productivity sectors of the economy. A case has been made for the encouragement of high-value added sectors of the economy on the grounds that it is within such sectors that the greatest growth potential lies. The above argument indicates a similar case on the grounds of a static analysis of resource allocation.

This is not necessarily to argue that such arguments provide the strongest basis for industrial policy, particularly given the case for a developmental approach to policy-making rather than the static approach alluded to above. Nevertheless, the points raised above do serve to highlight the relevance of efficiency wage considerations for the debate regarding subsidisation of high value added sectors of the economy. This might be viewed as complementary to a developmental, proactive approach. Lang and Dickens (1992) provide what they describe as a stronger case for industrial policy based on an efficiency wage - game theoretic model in which firms pay higher wages in order to avoid the costs associated with having unfilled vacancies.

6 Conclusions

In this chapter we have discussed a number of policy implications which follow naturally from efficiency wage theory. In contributing to one's understanding of a number of issues, specific policy proposals result from efficiency wage theory with regard to unemployment, minimum wages, discrimination and industrial policy.

Whilst a strong case could be made for arguing that efficiency wage theory provides a significant contribution to our understanding of each of these areas, perhaps their greatest contribution is with regard to explaining a source of deviation of markets from their competitive benchmark. The analysis in this chapter describes the sensitivity of the predictions of competitive theory to such a deviation. At the same time, such implications stress the potential importance of efficiency wage theory and place a premium upon empirical evidence designed to assess the merit of the underlying efficiency wage hypothesis.

Chapter 9

Summary and Conclusions

In the present Chapter we attempt to draw together the arguments and evidence contained in the previous Chapters in order to arrive at some general conclusions. The Thesis has examined the determination of wages in the British labour market and in particular has attempted to consider whether the process by which wages are determined may be accurately described as a competitive process or to what extent a case can be made for the existence of non-competitive wage premia. A number of aspects of the wage determination process have been examined with a view to analysing this important issue.

It was argued that a consideration of the nature of inter-industry wage differentials provides a context for examining the implied law of one price under competitive theory. Our results indicated that there remained an important degree of inter-industry variation in wages which was difficult to be reconciled with a market-clearing approach. Moreover, these differentials, particularly those on the basis of the cross-sectional evidence, were positively related to industry profitability. This would appear to provide a further basis to the argument that such differentials are non-competitive.

In turning to an analysis of labour turnover at British establishments, the Thesis considered the efficiency wage proposition that wages may be used by an employer as a means of reducing employee-initiated separations and hence avoiding the associated labour turnover costs. Evidence in support of this proposition was found. The analysis also allowed a consideration of the effect of certain forms of collective organisation upon labour turnover. The results suggested that trade union presence in particular, may have a quantitatively significant effect upon reducing levels of turnover. This is of importance in the literature concerning trade union labour market effects. It is consistent with the approach that suggests unions may have a favourable influence upon certain efficiency-related outcomes by improving the matching between employee preferences and actual, working conditions.

The predictions of competing approaches to the determination of wages were also examined in Chapter 5. The analysis considered the estimation of company-level wage equations for both employees and executives and, for the first time, attempted to model the two sets of wages in a similar fashion. Both the results of estimating the individual models and of non-nested tests suggested that whilst a non-competitive bargaining approach might most appropriately fit the data at the employee-level, at the executive level, there was evidence in favour of a more competitive approach to wage determination, albeit subject to labour market frictions.

This focus upon the distinction between the employee and executive levels of the firm, was continued in Chapter 6 which attempted to consider the efficiency wage proposition that wage premia enhance product market performance. At the executive level evidence in support of this proposition was obtained. This was not the case at the employee level however. Thus there may be important ways in which wage determination differs at the employee- from the executive-levels of the firm. In both cases there may exist deviations from the textbook competitive model.

The analysis then changed its focus somewhat in order to consider the issue of wage determination in the public sector versus that in the private sector. Despite representing a fundamental distinction that exists within the British labour market, differences in the forces of wage determination between public and private sector labour markets have received scant previous attention. Further, this clearly represents an issue of some policy importance. The results obtained suggested that on holding constant a number of rather finely defined individual and job characteristics - including industry affilliation - there was evidence of a significant wage premium for women being employed in the public sector, with no evidence of an overall wage differential for men. However, in large part this appeared to reflect the fact that public sector employment tends to be concentrated in the 'Other Services' industry sector, which tends to be a low-paying sector, ceteris paribus. Individuals employed in the National Health Service or Higher Education sectors experience a 10 - 12 % pay penalty relative to those employed in local government or local services.

In the long run, if labour is mobile then these differentials must be eroded. This raises the question of whether there are barriers to entry into certain labour markets. In the context of the efficiency wage model, the barrier to entry that exists is the fact that firms will not accept underbidding since to do so would reduce company profitability. Within the bargaining approach, it is the ability of current employees to impose costs, individually or collectively, upon the employer if the employer recruits from some outside group that represents the source of the mobility barrier.

The case of public and private sector is no less interesting. In the short-run, specificity of job skills is clearly likely to represent one source of barrier to labour mobility. However, in the long-term, human capital theory predicts that wage differentials will be considered in the assessment of human capital acquisition and hence occupational choice. On the implicit assumption that the above differential does not represent compensation for unobserved attributes of employment, then such differentials should not persist. However, although periodic reviews of public sector pay develop by way of a response to perceived difficulties in the public sector, the potential for significant costs in the intermittent periods should be highlighted. This suggests there may be a case for a more formal policy response which, ideally, should anticipate as well as react to developments within public sector labour markets.

The way in which individuals are rewarded for their participation in the labour market, represents an issue of considerable importance. As noted by Mincer (1970), the process of earnings determination represents a key determinant of the income distribution more generally, as well as representing a central factor in the determination of firms' employment decisions and individuals' labour supply. The focus of the present piece of research in fact goes beyond such concerns, in examining the potential presence of non-competitive forces in the process of wage determination. As has been highlighted at several points, evidence of non-competitive elements to the wage determination process would have several further important implications, not least for the behaviour of the macroeconomy. The evidence contained in the present Thesis, based upon several of the major large microeconomic datasets for Great Britain, has served to question the basis to a narrowly-conceived competitive approach to wage determination. The important policy implications which follow from such suggestions serve to place a premium upon further work in this area of research.

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